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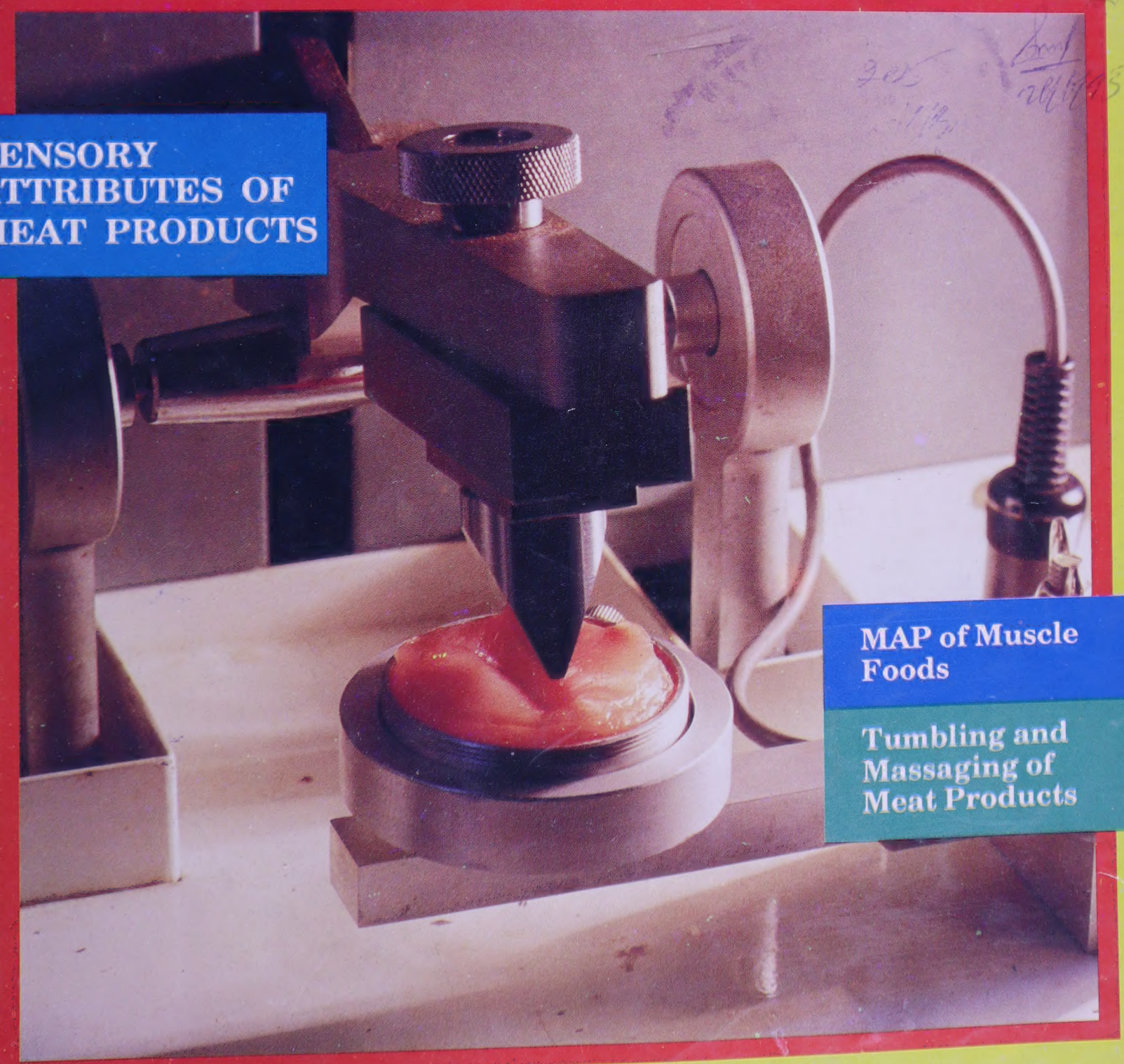

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* Affiliated to the Institute of Food Technologists, Chicago, Illinois, U.S.A.
* The Association is a professional and educational organization of Food Scientists and Technologists, with its headquarters at Mysore.
* The chapters of the Association the association are located at Bangalore, Bhopal, Bombay, Calcutta, Delhi, Hisar, Hyderabad, Jabalpur, Jaipur, Jammu, Kanpur, Karnal, Kharagpur, Ludhiana, Madras, Manipur, Nagpur, Pantnagar, Parbhani, Pune and Thiruvananthapuram.

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* Advancement of all the aspects of Science and Technology relating to production, processing and distribution of food, with the ultimate objective to serve humanity through better food.
* Promotion of research, development and training in the Science, Technology and Engineering of Food.
* To provide a forum for exchange, discussion and dissemination of knowledge and current developments, especially among Food Scientists and Technologists as well as the Public and Society at large.

Major activities :

* Publication of 'Journal of Food Science and Technology' (bi- monthly) and 'Indian Food Industry' (bi-monthly),
* Holding symposia/conventions on different aspects of Food Science, Technology and Engineering
* Arranging Lectures and Seminars for the benefit of Members and the Public.

Membership :

* Membership is open to graduates and diploma holders in Food Science, Technology and Engineering as well as to those engaged in these professional activities.
* Types of membership include Life Member, Life Member (Resident Abroad), Corporate Members, Full Member, Member (Resident Abroad), Affiliate Member, Student Member and Student Member (Abroad).
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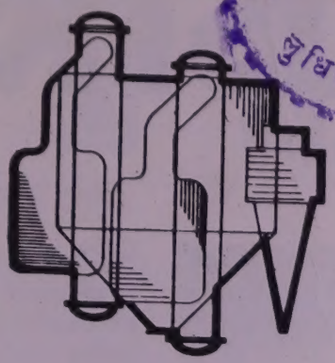

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INDIAN FOOD INDUSTRY

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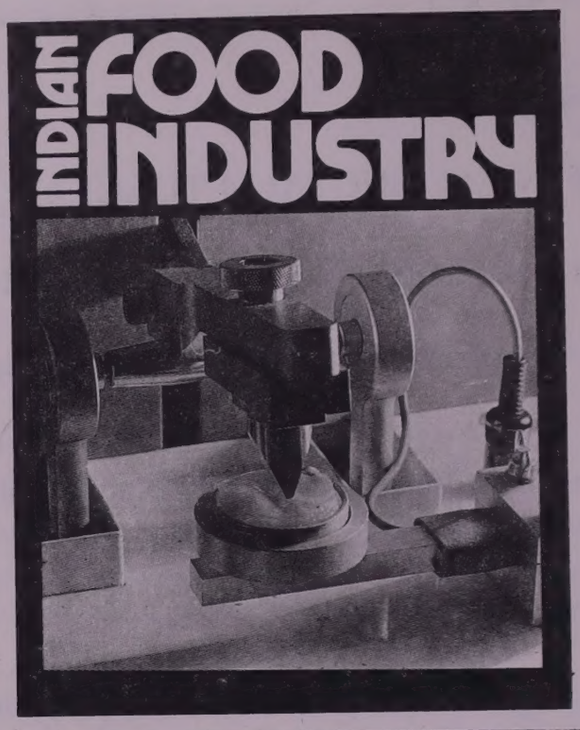

Cover :

Instrumental Evaluation of Meat Texture

Photographed by

M. Vishnu Kumar

Indian Food Industry (ISSN-0253-5025) is a bi-monthly publication of the **Association of Food Scientists and Technologists (India),** devoted to give extensive coverage to technological and market developments relevant to food industries in India.

Review articles, technology papers based on R&D work and reports on various aspects concerning food industry are welcome from food scientists and technologists from industry, research institutions and other related organisations. Contributors are advised to provide good quality illustrations in the form of charts and photographs along with the manuscripts. The Editorial Board reserves the right to edit the manuscripts in order to make them suitable for publication in the journal.

Food industries may send information (suitably illustrated with photographs) about their new products, machinery, business ventures and other developments, which will be published on the discretion of the Editorial Board.

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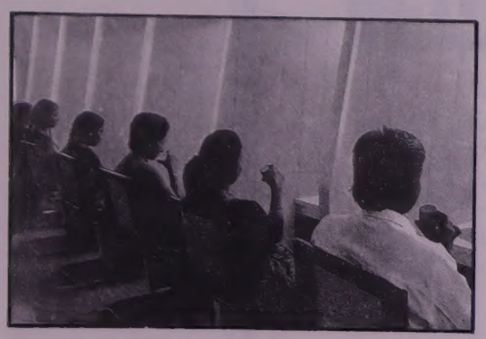
CONTENTS

MAY-JUNE 1995



EDITORIAL

Safety of foods has come to be of paramount significance and hence an integral ingredient in the Food Security. In our quest for ultimate food security through increased production, it is imperative that we hold larger stocks of food grains for longer periods on storage. In this context, we are compelled to influence and modify the natural behaviour of the foods through application of external protective and preservative agents and preserving conditions. This apart, the multiple agencies and channels through which the foods, processed or natural, reaches the ultimate consumer and the forms and ways they are consumed also have great relevance in safety of foods.

Regulatory mechanisms and statutory standards can only partly satisfy the needs of consumer safety of foods. The ultimate safety of foods is ensured, when consumers' right to know is ensured and satisfied. Thus, a mechanism and an authority to certify the safety and authentic information about the products has been a long felt need. A welcome step towards this is the initiation of CFTRI on a project on Food Safety Research. The modern facilities, the expertise and the new knowledge generated will be a boon to the monitoring, evaluation and safety of foods. Simulataneously, the processors and manufacturers also will be in a position to help consumers make their choice based on information on what they are buying and consuming. This process of consumer awareness will be an alternative in the long run to regulatory mechanisms and statutory standards and thus promote innovation and novelties in processed foods. This pioneering effort in Research and Development need to be acclaimed and patronised by industry and consumers alike.

S.P. Pillai
Chief Editor

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INDUSTRY NEWS

Major Share in R&D Expenditure by Private Sector

Private sector has a larger share in the number of in-house research and development centres and in the expenditure incurred in research and development.

At present, there are 1,230 in-house research and development centres, recognised by the Department of Scientific and Industrial Research (DSIR), the nodal administrative department for research and development in industry.

Of the 1,230 centres, public sector accounts for 45 per cent and private sector 55 per cent.

According to the wealth of technologies generated by in-house research and development centres, a DSIR publication released by Minister of State for science and technology, Shri Bhuvnesh Chaturvedi, the research and development expenditure incurred by the 1,230 industrial units, as a percentage of their annual turnover, as a whole was 0.57 per cent. The ratio for the private sector was 0.64 per cent and for the public sector was 0.51 per cent.

These research and development centres incurred an expenditure of Rs 1300 crores during 1993-94. Around 300 small scale industries incurred an expenditure of Rs 50 crores for research and development.

The present estimated manpower employed by the 1230 recognised centres is around 50,000. Of this, 32,500 are employed in the private sector in-house research and development centres.

Chemical and allied industries accounted for the largest share of 400 of the 1,230 research and development centres. This was followed by electrical and electronics industries with 350, mechanical engineering industries with 250, processing industries including metallurgical, refractories, ceramics, cement, textile, paper, leather and others with 150 and agro industries with 80.

New Patents in an Old Set-up

The promulgation of the Patents (Amendment) Ordinance harmonised the Patent Act, 1970, with GATT and made patenting of 'medicine or drug' products a reality.

Inventors can now obtain product patents for pharmaceutical products, unlike in the past, when it was limited to processing only. India has retained the option of a 10 year transition period for granting these patents. In the interim it would, however, grant exclusive marketing rights (EMRs), as a pipeline protection mechanism for such products.

After the transition period, the patent will be valid for 20 years. In the wake of these changes, there will be increased activity in basic research. In pharmaceuticals, especially new products rather than substitute formulations will have to be developed.

To be granted a product patent or an EMR in India, an applicant must have already been granted a patent and exclusive rights to sell the invention in some other country. Since no country is able to grant a patent before 18 months, it is unlikely that EMRs or patents will be given in a hurry in India. In addition, fear of infringement in India is minimal because of the lagging technology in these industry sectors. The emphasis, instead, is on whether Indian companies will be able to file for patents due to the prohibitive costs there, according to N K Sharma, Managing Director, National Research Development Corporation (NRDC).

The present systems of granting patent seem to be loaded against the applicant. "The time stipulations appear to be meant only for the applicant and not the authorities," says a patent attorney. After examination by the patent office, objections to applications, if any, are communicated to the applicant so that amendments can be carried out and the application refiled within 18 months. But it is common for the second examination itself to go on for several months and proceedings in case of opposition taking even longer. Examination should not take more than six months and the controller should either reply or grant the patent, if all queries are answered.

There are instances of inordinate delays. Having found a way to make magnesium oxide from sea water, a CSIR laboratory filed for a patent. But, a company thought otherwise and contested the claims. Even a decade later, the

case is yet to be decided, and a investment of several lakhs of rupees has gone down the drain.

The judicial process is so laborious and long-drawn that companies are reluctant to waste the 14 years of a patent's life in litigation.

A possible solution is granting a patent immediately on application, as is the practice in some countries such as Italy. As it is under Section 13 (2), a patent is not *prima facie* evidence of the validity of the invention or of its being original, which means that it can be challenged in a court of law.

Food Processing Industry - A View

Although the food processing industry is not specifically hi-tech or capital-intensive, it has its own problems. Corporates need to attend to factors like food safety and quality, apart from making sure their products satisfy the critical attributes like taste, falvour and texture.

Even multinationals have been rather cautious about venturing into this field. Their market penetration, say observers, have been rather slow on account of critical factors like tastes, which Indian consumers are unwilling to give up for convenience's sake. Moreover, high packaging costs, transportation, advertising and raw material costs have beaten quite a few of the players.

Almost 50 per cent of the total costs is incurred only in packaging. In order to ensure constant quality, the variation in the processing and packaging quality needs to be tackled so as to meet the stringent quality regulations laid down by EC countries. If companies fail to produce fruits, vegetables etc., for processing, they would have to compete with traders who can afford to corner the stocks at higher prices for sale as fresh products.

However, the land laws in the country are such that captive cultivation on a large scale is not possible.

Another major hindrance is the lack of adequate infrastructural facilities, India can provide today, in terms of cold storage, power supply, easy transportation etc.

However, there are reasons to be optimistic. The liberalised industrial policy attempts at providing an ideal base for attractive huge investments to promote the growth of this industry.

During the last few years, a number of companies employing state-of-the-art technologies such as vacuum concentration, aseptic packaging, freeze- drying and individual quick freezing plants have come up particularly in the processing of tomatoes, mushrooms, tropical fruit juice, pulps and concentrates. The growth of the processing units have been guided largely by the availability of infrastructural facilities and convenient markets, besides easy availability of raw materials.

The food processing industry *per se* holds great potential. But, it is a highly localized kind of industry. For instance, McDonald's may be a great hit in Bombay, but may not be so in Rajkot or any other remote area. As such, local brands have an edge over new foreign brands. However, the potential is there. The success of a project here would depend on how savvy the company is in marketing a quality product and creating a brand name.

At times, the cost of advertising exceeds the cost of products. Creating a brand name takes up a considerable period of time, thereby involving a long gestation period for new companies.

An investor would have to wait for at least 2/3 years for a new company to yield results, and the profitability would depend on the company's marketing expertise and ability to consistently beef up sales. It is a high-risk high-return segment. For instance, meat exporting companies should do relatively well, considering the demand for the same abroad. But a plague scare could place the company in the doldrums. Moreover, even if the company performs well, market sentiments for companies that produce meat or other non-vegetarian products is poor.

Knowing European Union's Import Requirements

Many of the European Union's (EU) complex food import requirements are changing, as a result of new EU single market regulations and will change further, as the GATT Uruguay Round (UR) agreement is implemented over the next few years.

Exporters will need to work hard to keep up-to-date on EU tariff and non-tariff access restrictions, phytosanitary and sanitary requirements and harmonized EU food standards and regulations.

Meat and Poultry Requirements

All beef, pork and horse meat imported into the European Union of human consumption must come from slaugther

houses, cutting plants and cold stores approved by the EU.

Since 1989, the EU has prohibited meat imports from cattle treated with growth hormones. U.S. producers of beef from animals *not* treated with hormones may export to the European Union. The cattle must come from an EU-approved source and must be slaughtered in a slaughter house that has been approved by the Union for handling untreated beef.

The EU is in the process of implementing new legislation that requires all animal product imports to undergo harmonized frequencies of documentary, identity and physical checks by veterinarians before entering the Union.

Recent legislation will transfer the authority for approving thrid-country poultry slaughter and processing facilities from the member countries to the European Commission. However, until this legislation is fully implemented, the member States will maintain separate lists of approved poultry facilities in third countries.

High Import Duties on Beef

The EU beef market is largely insulated from the world market by high import duties on most products. For example, imports of frozen boneless beef cuts face a variable levy (currently $1.30 per pound) plus a 20 percent *ad valorem* duty. Under the Uruguay Round agreement, the levy will be converted to a tariff equivalent of $1.14 per pound plus a 12.8 percent *ad valorem* duty in the last year's agreement.

Import opportunities currently exist for selected products that are already covered by fixed, relatively low tariffs or special import quotas.

Most notably, the EU grants levy-free access for annual imports of up to 10,000 tonnes of beef from the United States and Canada under a high-quality beef (HQB) quota. (imports under this quota are still charged a 20 percent *ad valorem* duty, which is preserved in Uruguay Round agreements.)

In addition to beef cuts entering the EU under the HQB quota, beef offal also is excluded from the variable levy. Beef livers carry a flat *ad valorem* duty of 7 percent, and all other beef offal is charged 4 percent on an *ad valorem* basis.

The Uruguay Round agreement will eliminate the 7 percent duty on beef livers in six equal annual instalments.

Pork Also Faces Levies

Market access will be improved through the creation of a tariff- rate quota totalling 75,000 tonnes by the year 2000, including a 39,000 tonne allocation to tenderloins, boneless loins and boneless hams. Pork offal imports are charged the same duties as beef offal. Under the Uruguay Round agreement, the 7 percent duty on pork livers will be eliminated in six equal annual instalments.

Until the Uruguay Round provisions are fully implemented, pork meat presented for import into the Union at prices below the EU's sluicegate price (an institutional price meant to reflect the world cost of production) will be charged a supplementary levy equal to the average difference sluicegate price.

Horse Meat Has Different Duty

The variable levy does not apply to horse meat imports. Instead, horse meat is charged a flat 8 percent *ad valorem* duty.

Poultry, Egg Rules Similar to Pork

Market protection for poultry meat and egg products works on the same principle as that for pork. When the Commission receives evidence that product has entered the Union at prices below the sluicegate price, it attaches an additional amount equal to the average difference between the import price and the sluicegate price to imports from that country.

Under the Uruguay Round agreement, sluicegate prices and the variable levy will be replaced by a fixed tariff. Access for poultry will be increased through the creation of a tariff-rate quota of 19,000 tonnes in 1995, increasing to 29,000 tonnes in the year 2000. The EU also committed to cut tariffs on processed turkey from 17 to 8.5 percent over the six-year implementation period.

Opportunities for Dairy Products

In general, dairy product imports into the EU are charged the variable levy. However, the duty for products containing sugar is calculated according to a complex formula that yields high levels of market protection. These levies will be converted to tariff equivalents under the Uruguay Round agreement.

Legislation recently adopted - but not yet implemented - by the EU will limit milk-based imports to countries and establishments that have sanitary controls equivalent to those required of the EU member States. Until this legislation is implemented, member nations will retain authority over health standards

for imports of milk-based products.

Check Closely for Animal Products

Animal products and by-products and products that contain ingredients of animal origin are covered by harmonized EU legislation. Until this legislation is fully implemented, however, member State rules will continue to apply.

In most cases, including when the products have been treated with heat or irradiation, the country of destination will require that an official government export document accompany the shipment. This applies regardless of whether the product is for human consumption, pharmaceutical use or for non-human use such as, veterinary biological, animal feeds, fertilizers or for research.

Generally, animal products for human consumption may originate only from plants that have been previously approved by the country of destination.

Most animal products and by-products currently exported to the EU, including inedible tallow and cattle hides and skins, enter duty free.

For animal products and by-products not for human consumption, Animal and Plant Health Inspection Service (APHIS) frequently is asked to provide export certification according to the country of destination requirements.

Under the harmonized standards now in place, one set of requirements applies throughout the EU. However, until the harmonized legislation is fully implemented, U.S. exporters should ask importers to contact their governments to determine current restrictions.

Horticultural Items Restricted

Horticultural products face a number of border restrictions. In addition to considerable tariffs, which vary by product, many horticultural imports face an additional price restriction in the reference price system.

This system protects internal EU prices, which are generally well above world market levels. If imports are priced below the reference price, an additional countervailing duty is charged to bring the import above an internal administrative prices.

The minimum import price system used for raisins is similar to the reference price system. Raisin imports valued below a fixed reference price are charged an additional countervailing duty. Here again, U.S. exports have not been subject to the countervailing charge because they have been priced above the minimum import price.

Under the Uruguay Round agreement, the reference and minimum import prices, the countervailing charges and the duties for horticultural products will be reduced by an average of 36 percent. These reductions will create increased export opportunities for several products. For example, the tariff on single- strength orange juice will decrease from 19 percent in 1995 to 12.2 percent by the year 2000.

Other significant cuts include a 75 percent reduction in the duty on fresh foliage ; a 50 percent cut in the duty of shelled almonds, in-shell walnuts, and apples from January through March ; and a 36 percent cut in the duty for fresh asparagus, shelled walnuts, fresh grapes, apples from August through December, roasted almonds, roasted pistachios and potato chips.

Pesticide Residue Limited

In 1990, the Union passed a legislation that requires mandatory, EU-wide maximum residue levels (MRLs) for most commonly used pesticides.

The European Commission is working with the member States to establish lists of compounds for which MRLs will be developed and recommended for final approval. The Commission has started with the pesticides most commonly used in the Union. The first two groups of maximum residue levels were published in July 1993 and June 1994.

For other pesticides, individual country regulations will remain in effect until a harmonized MRL is established.

Processed Products Charged

In addition to bound import duties, the EU has a complex system of border protection measures for food products. Since prices for such basic agricultural commodities as dairy products, sugar and cereals are considerably higher than world prices, the EU maintains a mechanism to protect European consumer-ready food products from imports made with lower-priced inputs.

Thus, most processed products entering the Union are subject to additional import charges based on the percentage of sugar, milk fat, milk protein and starch in the product. These additional charges have made imported processed products non-competitive in the European market. As these charges are converted to fixed tariff equivalents and reduced under the agreement, the situation should improve.

For several years, the EU has been harmonizing the often divergent member State regulations on food. Early attempts focussed on what are called vertical directives. These directives identify specific characteristics and requirements for food products and cover items such as cocoa and chocolate products, sugars, honey, fruit juices, jams and mineral water. These directives are being revised.

The Commission has shifted to a horizontal approach that aims to set standards that apply to all food products. So far, directives have been adopted on packaged and frozen foods, labelling, substances in contact with food, lot marking, dietetic foods and contaminants. Other proposals on irradiation, food hygiene, additives, nutritional claims and novel foods are in various stages of the legislative process.

Fresh Fruits and Vegetables - Hong Kong Scene

The value of Hong Kong's imports of fresh fruits and vegetables which include dried products such as figs, dates, and coconuts - has increased by 47.8 percent since 1988.

In volume, imports have increased a less impressive 12.4 percent over the same period, from 791,000 metric tonnes (MTs) to 890,000 MTs. Import consumption is actually lower than total import. Hong Kong re-exports 10-14 percent of fresh fruit and vegetable import tonnage.

Because Hong Kong is a duty-free port, no import tariffs are charged on fresh fruits or vegetables. Phytosanitary restrictions are not strict, although some wonder whether China will impose its much stricter phytosanitary regulations-primarily targetted at the Mediterranean fruit fly (Medfly)- when Hong Kong returns to Chinese control in 1997.

In Hong Kong, the main vegetable crops that grow year round, with peak production in the cooler months, are white cabbage, flowering cabbage, lettuce, spinach, Chinese kale, radishes, watercress, leaf mustard, spring onions, and chive. Long beans, water spinach, cucumbers, and several species of Chinese gourd are produced in the summer. Winter vegetable production includes tomatoes, sweet peppers, cauliflower, cabbage, carrots, and celery. Straw mushrooms and other edible mushrooms are also produced. Many fruits are grown on the lower hill slopes, including lychees, longan, wampei, local lemons, oranges, tangerines, guavas, papayas, and bananas.

German Expertise for Seafood Processing

A six member German delegation has urged Indian seafood exporters to adopt advanced methods to improve product quality to boost their image in Europe in general, and Germany in particular.

The delegation said that Germany could provide the Indian seafood industry with fish processing machinery, technical training, and expertise to process seafood with a buy-back arrangement.

Dr. Varghese Director, Marine Products Export Development Authority said, that the Indian seafood processing units had been asked to fulfil the EEU's requirements by December 1995.
But,according to the Director, International Operations, Frigo Fischtechnic GmbH and Bremerhaven, Dr. Selgfried Bank, it would take five years to achieve this.

According to the Vice-president, Frionor AG, the import of seafood by Germany would go up because of two major reasons - first the marine resources of the country had depleted and second, there was a major shift in demand from meat products to seafoods for health reasons.

More of Shrimps

Aquaculture, received a setback in Andhra Pradesh twice this year. Once, when a cyclone struck wiping out three-fourths of the crop in the Krishna, Guntur, West Godavari districts and parts of East Godavari district and next, when an unidentified disease left a trail of destruction in shrimp ponds in the State. The total crop loss could be about Rs. 250 crores. AP had exported Rs. 400 crores worth of shrimps last year.

Marine Products Export Development Authority (MPEDA) suspects the disease to be Infectious Haemotopic Hypodermal Nechrosis (IHHN) virus and recommends disinfection of the farms with lime.

However, Dr. John S. Clark, a consultant to Hindustan Liver and Rank Aqua, disagrees with the MPEDA diagnosis and feels that there is no need to observe a crop holiday. "I am

absolutely sure that this is not a IHHN virus. This type of virus does not cause mortality in black tiger shrimps."

Dr. Clark says that root cause for the large-scale death of shrimps in the farms around Kandaleru creek in Nellore district is environmental stress, an off-shoot of bad water management. His findings showed 16 times higher-levels of suspended solids, 200 times higher-levels of ammonia, 25 times more of chemical oxygen demand (COD) and 15 times more of biochemical oxygen demand(BOD). Because of less tidal flux, the water in Kandaleru creek is getting stagnated.

Regarding the outbreak of white spot syndrome in the cyclone affected area, he said, it has been due to osmotic shock and mineral imbalances. He had also detected the presence of pesticides such as Lindane (17.4 particles per billion). Dieldrin (1.2 particles per billion) Parathion (5.8 particles per billion) and Butachlor (0.4 particles per billion) in the farms of these areas. He said that the pesticides could have passed into the shrimp ponds from agricultural farms through flood water.

Besides, he said, during cyclone, temperatures fell from 27 ^{0} C to 20 ^{0}C and salinity fell from 20 parts per thousand to 5 parts per thousand. Adding to this was low light-level, which led to algae bloom failures causing stress to shrimps. His analysis revealed that no viral, bacterial or fungal bodies associated with the white spots.

Prof. Lightner of the University of Arizona, USA, diagnoised the disease as 'China Virus', a recently recognised virus. Prof. Lightner is stated to be a pioneer in detecting virus in shrimp and has detected IHHN virus for the first time and also developed a shrim-probe to detect it at the hatchery or farm itself.

Based on the finding, American Standard Products Inc. (ASPRO) started developing several non-chemical formulations with an integrated approach to fight the problem. These include a package of immuno-stimulant vaccines and probiotics to be used from early stages of shrimp life cycle. In addition, the company's Asprobiotic Formulae clean the pond of all waste material.

However, the use of ASPRO's package means an additional cultivation cost of Rs. 65,000 per hectare. With 90 per cent of the aqua farmers having holdings of two hectares and below, it is anybody's guess whether they would be able to absorb such an additional cost.

The Central Institute of Brackishwater Aquaculture (CIBA) of the Indian Council of Agricultural Research also conducted a study on Kandaleru creek after the outbreak of the disease. Its finding was that the disease was indicative of primary viral infection, a predisposing factor for secondary bacterial infection of high severity. Water degeneration is most likely to have triggered viral infection.

Similarly, the Department of Marine Living Resources of Andhra University believes that the outbreak was caused by pathogenic bacteria of vibrio group. On the other hand, the CP group of Thailand feels that it was caused by DNA virus, which was not serious and can easily be overcome.

However, though they differ on what caused the damage, all of them agree that unscientific farming and bad water management was responsible for the problem. There are 61,869 small farmers and 422 big farmers in the State engaged in aquaculture and most of them neither have the technical know-how nor the inclination to go in for scientific farming. Consequently, soil and water pollution is rampant.

More Concessions to Aquaculture

Aquaculture would soon be eligible for concession on lines of those being enjoyed by the agricultural sector.

The Ministry for non-conventional energy sources has supported aquaculture for receiving the benefits of subsidised electricity and water, easier availability of credit and income tax exemption.

A National fisheries policy is being prepared with representatives from various ministries such as commerce, food processing, fisheries and relevant ministers from various States.

There are 30 feed mills in the country producing 50,000 tonnes of feed, whereas the actual demand was 90,000 tonnes. Equipment such as aerators were also needed to be manufactured indigenously to ensure availability, spares and service.

Aquaculture, in general, had created substantial employment opportunities, while it revolutionized the rural economies in Andhra Pradesh and Tamil Nadu in particular. This makes aquaculture a thrust area.

To ensure the growth of aquaculture, the government has also decided that it shall remove all obstacles being faced by shrimp farmers. The aquaculture industry feels that the recent episode of disease attacking shrimps in A.P. should be taken

seriously to identify the natural cause of the disease.

Mushroom Ventures in India by AVI Ltd.

According to Moshe Volfovitch, a mushroom production specialist and chief agronomist with Israel-based Asia Ventures International Ltd (AVI), his country plans a manifold increase in assistance to India, not only for mushroom cultivation, but other diverse agricultural operations as well.

Moshe told that AVI had bid for a mushroom project being planned by cooperative fertiliser major Kribhco in Haryana. The proposed plant will have a yearly capacity of 3000 tonnes of button mushrooms, mostly for the export market.

In Andhra Pradesh alone, Moshe said his company was providing technology to four companies which were taking up mushroom cultivation in a big way. These are Classic Mushrooms Ltd of Visakhapatnam, Esskay Agro Tech Ltd of Chittoor, Sugam Agro Tech Ltd of Kakinada and Mushroom Impasse India Ltd, a Hyderabad-based firm having a tie-up with VST Industries Ltd.

According to Esskay's Managing Director, A. Giridhar, mushroom project, involving an investment of Rs. 34.86 crores, will be located in Nindra village in Chittoor district on the Madras -Tirupati highway. The project is a 100 per cent export-oriented unit.

Giridhar said that Esskay has entered into a marketing arrangement with the Hong Kong outfit of AVI under which the company will lift the entire production for a seven year period.

Funds for Himachal Mushroom Project

The Himachal Pradesh Agri Industries Corporation (HPAIC) has received the sanction of the National Horticulture Board for a Rs. 12 crore mushroom project in a joint venture with Agrogold, a private firm, at Nalagarth in Solan district.

The project would produce 1,500 tonnes of mushroom per annum. It would be 100 per cent export-oriented.

The Dutch Association for High Quality Potatoes

The European potato giant, Agrico Project BV, has entered into a 50 : 50 joint venture with Quality Tea Plantations Pvt. Ltd (QTPL) of Calcutta. The potato cooperative company of the Netherlands will soon introduce select varieties of high quality potatoes in India in the tie-up with the Calcutta company.

According to Marketing Director of Agrico Project BV, India had been chosen because of its leading position in potato research in Asia, easy availability of inexpensive agro-economic inputs and ideal location for exports to South-East Asian countries.

In the opinion of the company, the food processing industry in India was in need of the right quality of potatoes with high dry matter and low reducing sugar content for making high quality value-added food products, such as French fries, chips and flakes.

The proposed joint venture is expected to meet the critical raw material requirements of the Indian food processing industry.

Agrico, which at present supplies more than 100 varieties developed by its own variety breeders to more than 70 countries, is a cooperative of about 2,000 potato farmers in the Netherlands with an annual production of some 400,00 tonnes of seed potatoes and about 800,000 tonnes of table potatoes. It exports about 60 per cent of its produce to over 70 countries across the globe.

QTPL is engaged in tea plantation, manufacturing and international trading for the last two decades. The new venture is a diversifying activity for the QTPL.

The joint venture company is likely to export 20 per cent of its total seed production.

Japan More Interested in Convenience Foods

Consumer demand for convenience foods is bringing rapid growth to Japan's microwaves, toaster and retort food processing sectors.

The fastest growing segment of the Japanese microwave market is frozen rice products, which account for 47 percent of total sales. Popular products include rice pilaf (a pre-cooked rice combined with vegetables, seafood or beef and seasoned with butter, soy, curry

or other spices) and *onigiri* (rice balls).

Sales of highly successful and popular products - rice balls fried in a soy-based sauce and Japanese-style box lunches featuring rice combined with various items, including mini-omelettes and Vienna sausages - were expected to see increased sales in 1994.

In the toaster oven foods market, successful product lines include frozen snack foods, such as grilled chicken, spiced chicken, potato balls and pizza and a potato snack food wrapped in meat.

Other popular toaster oven items include fried foods, such as frozen croquettes (friend dumplings made from potatoes), breaded cutlets made from vegetables and pork, chicken or hamburger patties made from a combination of beef, pork, chicken and vegetables.

Consumer demand for convenience foods has spurred growth in the retort-packaged food market as well. Originally developed for camping, these products have gained wide acceptance in Japan due to improved technology and quality. The most popular retort product in Japan is prepared curry, which accounts for nearly 50 percent of total production, followed by pasta sauce and soup.

Some of the convenience food manufacturers are looking for frozen mashed potato balls used in croquette production ; frozen pre-cut vegetables for rice pilaf and retort curry production ; frozen, shredded and sauteed onions used in box lunches, frozen breaded cutlets and frozen hamburger patties.

To be successful in this market, suppliers must be willing to adjust their products to meet the needs and tastes of Japanese processors and consumers.

Quaker Oats to Enter Indian Market

The Quaker Oats Company has got an approval from Foreign Investment Promotion Board (FIPB) to acquire 100 per cent shares in the new company to be formed in India, namely, Quaker Oats India Private Limited.

The US $ 6 million company proposes to invest $ 20 millions in this project. The company plans to commence its operations in India with the introduction of its range to beverages, beginning with Gatorade, which is a non-carbonated beverage.

In India, due to abundance of locally grown fruits, Gatorade will also contain fruit juice or its concentrate. The company estimates to utilise 250 tonnes of fruit juice or concentrate in first year of its operation and subsequently increase it to 2000 tonnes in the fifth year.

In addition to Gatorade, the company also plans to introduce its mixed tea and fruit beverages sold under the brand name, Snapple.

The company proposes to bring in approximately Rs. 2,220 millions towards capital assets etc., in the first five years of its operations.

The key product lines of the company are : value-added cereals, rice and pasta ; grain-based beverages and snacks ; and functional and health beverages.

Marine Product Exports May Cross $ 1-b. Mark

The export earning from marine products could reach $ 1-billion mark during the current year as against Rs. 2,503 crores last year. Marine products worth Rs. 1,900 crores had been exported till November and their exports are likely to cross the target of Rs. 3,000 crores this year, according to Mr. K. B. Pillai, Chairman of the Marine Products Export Development Authority (MPEDA).

Delivering a key note address at the inaugural ceremony of the three-day Indian Aqua and Marine Trade Fair-94,. Mr. Pillai said that out of the target of one lakh hectares during the Eighth Plan, 82,500 hectares had been so far brought under shrimp farming, whose output accounted for 62,000 tonnes per annum. The country had 1.2 million hectares of brackish water land out of which 2 lakh hectares would be suitable for aquaculture.

About 150 hatcheries were coming up in the country and hence, there would not be any shortage of shrimp seed in future. The production of shrimp seed was expected to increase to 5,000 million in 1995-96 and 7,500 million by 1996-97.

Mr. Pillai, however, expressed concern over the growth of unorganized shrimp farms and emphasized the need for formulating a coordinated national plan for the development of the aquaculture in the country. A national perspective was essential for regulating the industry, he felt.

In this context, he said that MPEDA had assigned the National Environmental Engineering Ltd to study and fix the parameters for the regulated development of aquaculture. Basing on the study, the guidelines would be formulated which have to be adhered to by shrimp farmers.

Stating that the demand for marine products was increasing at a rate of 2 per cent per annum, while the increase on the supply side was only 1 per cent, Mr. Pillai said that it was time that we had concentrated not only on shrimps, but also on the production of other marine products.

The President of the Aquaculture Foundation of India, Dr. M. Sakthivel, expressed that coastal belt in the country should be classified into separate zones of aquaculture and agriculture so that there would not be any hindrance to the growth of the multi-billion dollar shrimp industry.

EOU in Andhra for Frozen Vegetables

A 100 per cent export-oriented unit for manufacturing vacuum- frozen dried fruits, vegetables and marine products is being set up in Nalgonda district of Andhra Pradesh in financial collaboration with a Danish group.

The joint venture project would cost Rs. 14 crores and is being implemented by a former Unido consultant Codur Sekar. According to him, the project has enormous scope as the raw material and manufacturing costs in India are low and the products have a ready market abroad. He said that European Agro Industrial Development Company, is a wholly-owned subsidiary of Skako of Denmark, belonging to the Skako group.

Coduras Exports Ltd, is setting up a unit for producing vacuum freeze-dried (VFD) vegetables, fruits, and marine products. The company is implementing the project with a plant in Bhongir village of Nalgonda district of Andhra Pradesh with a capacity for procuring 1,65,000 kg of dry products per annum from an input of fresh vegetables, fruits and marine products of about 20,13,000 kg.

Besides, AP is the second largest producer of vegetables and fruits, and has a long coastline, thus assuring a constant supply of raw materials.

Critical and state-of-the-art machinery are proposed to be acquired from Atlas Industries A/s Denmark and from Urschel, Denmark. Atlas will also provide technical know-how and basic engineering, design and engineering support, training and R&D. Back-up services for the machinery will be provided by L & T, Bombay. according to Codur Sekar.

Market Demand for Indian Frozen Vegetables and Delicacies Up

The market for frozen Indian vegetables and delicacies abroad is expected to be 32,800 tonnes in 1996-97. The market is growing at a rate of over 10 per cent per annum and the present market is estimated at Rs. 500 crores. Exports of processed fruits and vegetables has established a growth rate of 16 per cent per annum in the past few years and is expected to grow at a rate of 20 per cent per annum in the coming years.

The total international market for dehydrated vegetables is 115,000 lakh tonnes.

Milk Products for Export to Double

India would soon be in a position to double its milk product export target to $ 10 millions, following the recent decanalisation of exports of such products and various dairy development schemes including 'Operation Flood', the Minister of State for industry, Mr M. Arunachalam, said.

The increase in milk production has already made India the second largest producer in the world and placed the country in a position to export milk products, Mr Arunachalam added.

He further said that the country exported milk products worth about $ 5 millions in 1993-94 and would be in a position to double this to $ 10 millions. The minister exhorted the milk industry to incorporate the technological advancement made in the field and called for research and developmental efforts geared towards import substitution.

Golden Agro Setting up Fatty Acid Manufacturing Plant

Hyderabad- based Golden Agro-Tech Industries Ltd is establishing a Rs 18.85 crore fatty acids manufacturing unit at Rayapuram near Kakinada. The project will have a daily capacity of 42.50 tonnes. The project using commercial grade rice bran oil will also generate other by-products like glycerine, oxygen gas, pitch, and others.

Logo Campaign to Begin in Gulf

The next phase of the Indian spices Logo promotion in the Middle East Market is scheduled to begin shortly. The Board in consultation with the exporters who had been awarded the spices logo has finalised a multi media plan. The promotion programme includes publicity in the print media as also electronic media.

The Spices Board will be releasing campaign advertisements in select newspapers in the Gulf market, besides in the Gulf editions of the leading Indian newspapers. The aim is to make the general consumers aware of the Logo concept. The advertisement also makes a general appeal to the readers to look for the spice logo in every pack of spices, they buy. The logo has been called as the symbol of purity and quality. The advertisements in the print media will be released in three phases. One set of advertisements will focus on the cardamom concept and the other on black pepper and other major spices. Yet another advertisement focusses on the spice blends.

BIS Code for Hygienic Practices for Units for Processing and Handling of Quick Frozen Foods

Bureau of Indian Standards has formulated IS 14134 : 1994 Code for Hygienic Practices for units for processing and handling of Quick Frozen Foods. Customers are not generally aware of the hygienic quality of the food they purchase. For this, they rely on the hygiene standard of various industries that prepare and handle foodstuff. This code prescribes hygienic conditions and practices required for establishing and maintaining units for processing and handling of quick frozen food products.

This code is subject to the provisions of the Factories Act, 1948 and the Prevention of Food Adulteration Act, 1954. Considerable assistance has been derived from the Recommended International Code of Practice for the Processing and Handling of Quick Frozen Foods CAC/RCP 8-1976 published by Codex Alimentarious Commission.

Indian Standard on Palm Jaggery (Gur)

Bureau of Indian Standards has formulated IS 13952 : 1994 Indian Standard on Palm Jaggery (Gur). Palm jaggery (Gur) is manufactured for human consumption by processing of *Neera* (palm juice) obtained from four varieties of palms, namely, palmyrah palm, date palm, sage palm and coconut palm for human consumption. It had been noticed that palm jaggery manufactured in different regions of the country varies widely and each part of the country follows local practices for quality attributes. This specification has been formulated to provide suitable guidance to the palm jaggery industry for manufacture of quality products.

In the formulation of this standard, due consideration has been given to Rules prescribed by the Government of India, under the Prevention of Food Adulteration Act, 1954 and Standards of Weights and Measures (Packaged Commodities) rules, 1977.

Creamy Intrusion

Convenience foods are in. Fresh Coconut Oil Products, a Kerala- based manufacturer of coconut shell powder and other coconut -based products has launched Freshco canned coconut cream.

As the name suggests, this ready-to-use coconut milk concentrate is made from fresh coconuts. A 200 ml tin of Freshco is available for Rs 20, while a 150 ml pouch is priced at Rs 12.50.

The sealed can has a shelf-life of a year-and-a-half. Currently available at retail outlets in the metros (besides Kerala), it plans to go national by mid '95.

Freshco can replace fresh coconut milk in any dish, be it a curry, jam, dessert or even a cocktail. Freshco can also be used cosmetically as moisturising cream or for hair nourishment.

As a food ingredient, the brand targets housewives and institutions such as five star hotels, restaurants and bakeries.

The product is supposed to save the bother of breaking, scraping and squeezing coconut kernels without any loss of flavour or freshness. The extra amount the consumer pays is for convenience.

Campco Chocolate in the News

Campco, the multi-state cooperative society is to enter into a marketing alliance with the state-owned Mysore Sales International (MSIL) in a bid to reposition itself in the growing Indian chocolate market.

The tie-up with MSIL will be restricted to marketing of Campco's chocolate brands and the drinking chocolate-Winner, according to the controller of marketing, MSIL.

To begin with, MSIL will market Campco brands like - Treat, Turbo, Megabite, Funbite and Eclairs in two States. Also to be launched will be the drinking chocolate brand - Winner. Campco Playtime, creamy milk chocolate and creamy white chocolate will also be a part of the new marketing.

The chocolate business accounted for just Rs. 7.75 crores out of a total sales turnover of Rs. 117.09 crores at Campco in 1993-94. The current tie-up is aimed at grabbing a larger share of the Indian chocolate market which is estimated to be growing at the rate of 15 per cent per annum.

Campco which has an installed capacity of 8800 MT per annum will initially invest Rs 6 to Rs 10 crores to increase production capacities in both crushing and moulding. It is learnt that the expansion is already under way.

Nestle's arrangement with Campco for partial use of the manufacturing facility is likely to remain unchanged according to company executives.

Now, the Decaffeinated Coffee

Ashraj Foods and Beverages Ltd, makers of MR brand of coffee plan to launch decaffeinated coffee for the first time in India, after the launch of Instant coffee. Subsequently, they plan to launch Instant 'chai' also. The company is also set to introduce the conventional tea in international packaging and composite packaging.

Besides the conventional tea, flavoured tea will also be introduced. The company intends to deploy the latest method, freeze- drying process, to make coffee and tea.

According to the company's management, through the freeze-drying process, no flavour is lost. Freeze-dried coffee is a bit more expensive as the technology used is sophisticated. It may cost around Rs. 1200 to 1500 per kg as against Rs 1000 for spray-dried coffee.

The group plans to install a four-in-one plant with a capacity of 250-1000 kg per hour. The speciality of such a plant is that instant coffee, instant tea, soya milk powder an concentrated fruit juices (citric fruits), can be produced with the same plant and machinery, according to the requirements or demands. As part of its diversification, black and white pepper will be marketed in the first instance under the brand name MR condiments. This will also be packed in international packaging. Cardamom and cloves too will be launched subsequently. Spices, particularly white pepper, will be targetted for the export market and will be packed in attractive composite boxes.

Godrej Foods' Strategy to Market Fruit Drink

Godrej Foods has adopted a strategy to sell the product "Jumpin" to airlines, hotels, trains and various other canteens of well known institutions with the explicit understanding that the buyers will push the product.

Godrej has now managed to corner Indian Airlines which has the maximum number of domestic flights in India to exclusively market "Jumpin".

This plan has also paid off well for Godrej, as the sales of "Jumpin" for the year 1994-95 have increased to 26 lakh trays of "Jumpin" (each tray consists of 27 packs), from 9 lakh trays in 1992-93.

This strategy would make the customers get used to the taste of the drink (to compete with Frooty which immediately strikes the customer's mind and

has a lead in the tetrapack market). This would also assure to keep the sales up and to add on to the retail market sales.

The number of distributors for the company have also risen from 346 last year to 935 this year. Godrej ventured into supplying "Jumpin" in bulk, to Indian Airlines. The company then expanded their base to cover a number of private airlines as well.

Scientist's Call for a New Approach

Dr. M.S. Swaminathan, eminent Agricultural Scientist, while addressing the Third World Spice Congress in Kochi said "agriculture, industry and lifestyles will hereafter have to be based on conservation ethics."

He felt that ecologically sustainable practice of cultivation and new bio-environmental methods of pest control will have to be made obligatory.

For further development of spice industry in the country, he suggested setting up of a National Grid of Gene Banks in Spice Crops.

Ready Foods to Get Refrigerated Ship

The Madanapalle-based Ready Foods Ltd will be the first Indian company in the food sector to acquire a medium-sized refrigerated cargo vessel.

The company management has already made known its intention to buy a ship for its captive use and has sought the necessary Reserve Bank permission. The ship is likely to cost about $1.5 million. The company's Chairman and Managing Director, Raja Reddy is seeking the help of Monaco of UK to manage the ship. Both of them are likely to invest 50 : 50 each according to reports.

It also intends to acquire refrigerated trucks to transport the company's products on a regular basis to its cold store at the Madras port. The company has modern manufacturing facilities and its products are readily accepted by demanding buyers from Western Europe.

The company intends to buy two used container ships built either in Germany or Japan and ply them non-stop between Madras and onwards to Felixtowe and Hamburg.

On the way back, it would carry waste paper to India which has ready buyers.

Zee TV Not Accepting Direct Liquor Commercials

Viewers will no longer see advertising that directly shows a liquor bottle on Zee TV. Reason : the satellite TV channel's management has drawn up a liquor policy, or code, which says that it will not accept any direct liquor TV commercials. It, however, is open to surrogate liquor TV commercials, wherein cards or openers are used and advertised under the liquor's name.

There's a rider to this too : surrogate ads will be accepted only after 9.30 pm at night. This apart, the new Zee policy forbids programmes to be branded with names of liquor. Zee TV's vice-president (marketing & sales) Meenakshi Madhavani said "There are reasons why we have taken this decision. There has been a negative feedback from viewers. And also direct liquor advertising is not allowed under (Indian) law."

Pizza Hut, KFC in India Under Common Management

PepsiCo International has decided to bring its world renowned restaurants Pizza Hut and Kentucky Fried Chicken (KFC) under a common management in India - KFC India Holdings Private Ltd.

The decision to 'go it together' follows an international re- organisation in PepsiCo, where the restaurant business worldwide has been amalgamated under a single operating unit, called PepsiCo restaurant International

The new company, headquartered in New Delhi, will control operations for both these restaurants.

KFC would be a self-service restaurant and serve mainly chicken-based dishes, Pizza Hut would be a full service restaurant. The combination of KFC and Pizza Hut would provide full and varied meals to its consumers.

Initially, there would be four outlets of KFC in Delhi and Bangalore. However, the project of Pizza Hut is still in the pipeline. The long term plans are to open 30 facilities in six major metros Bangalore, Bombay, Calcutta, Delhi, Hyderabad and Madras.

India has a high potential in fast food business and it can

grow as big as in Japan which has 1,000 restaurants of KFC. The future plans of KFC involve having at least 2,500 restaurants in operation from Japan to India.

In another significant development, KFC and Pizza Hut will make an investment of US $80 million in India over the next seven years.

Success of Bagpiper Whisky

Bagpiper Whisky, a brand owned and marketed by Herbertsons Limited has become the single largest whisky in India and the seventh largest selling whisky in the world.

The company posted sales of 3.3 million cases in '93-94. It hopes to sell 4 million cases of Bagpiper by the end of 1994-95. This will make Bagpiper Whisky the fifth largest selling whisky in the world.

New Scotch Brands from MacDonald Mohan Distilleries

MacDonald Mohan Distillers Limited, a 50 : 50 joint venture between Mohan Meakins and UK-based MacDonald and Muir Ltd (M and M), is planning to launch four new brands of scotch-blended whisky some time this year. These brands are being developed by the foreign collaborator to cater exclusively to the Indian market.

The two brands to be launched in scotch-blended whisky are finalised. They are Grand Fortune and Grand Monarch. The company will be exporting these brands as well. A final decision on the other two brands has yet not been taken.

According to Mr Keith Steel, Sales Director, M and M "in the first phase of the operations, the company launched Highland Queen. The second phase will bring the new scotch-blended brands in the Indian market."

The company has launched 100 per cent scotch Highland Queen in Bombay and Calcutta and is planning to launch the premium scotch in Uttar Pradesh and Haryana.

Karnataka Milk Federation(KMF) to Make Cheese, Ice creams

Mother Dairy of the Karnataka Milk Federation (KMF) will diversify into cheese and ice cream production.

The foundation for the cheese plant to be set up in Kolar district will be laid shortly. However, the dairy was awaiting Central Government's approval for commencing ice cream production.

Already most of the machinery for the Rs. 1.36 lakh plant to produce 3,000 litres of ice cream had arrived and the production is expected to commence in about 10 months time.

Bambino Foods' Expansions

Bambino Food industries Ltd (BIFL) is to set up a unit at Begampur Khatola village in Haryana to manufacture pasta products such as vermicelli, spaghetti, macaroni and noodles with an installed capacity of 4,320 tonnes per annum.

In addition, the company will have a 60,000 tpa wheat milling facility for producing semolina, *maida, atta* and bran. The semolina produced will be for captive consumption for producing pasta products. The products would be sold under the brand name "Bambino."

FEATURE ARTICLES

Sensory Attributes of Meat and Meat Products

Modified Atmosphere Packaging of Muscle Foods : Technology, Shelf-life and Safety Aspects

Tumbling and Massaging - An Emerging Technology for Meat Industry

Sensory Attributes of Meat and Meat Products

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Sensory evaluation of foods including meat refers to their scientific evaluation through the application of human senses. Even though highly sensitive measuring instruments are now available, the importance of sensory analysis has grown over the years, instead of going down. The reason is that our senses which are biological detectors can perceive odour, taste etc. even below the lowest limit of instrumental sensitivity (Jellinek, 1985). Instruments usually analyze only a single component at a time, whereas the overall impression and taste of a food product can be properly assessed only by human sensory perception (Winter, 1990).

Muscle, which is ultimately converted to meat, is composed of approximately 75% water, 19% proteins, 2.5% fat and 3.5% soluble non-protein substances. Less than 5% of the total water is directly bound to the hydrophilic groups of proteins, the rest being either free or loose water depending on its mobilization. The fat content varies in quantity and composition between muscles, species, sex etc. Muscle proteins have been classified as sarcoplasmic (water-soluble), myofibrillar (salt-soluble) and stroma proteins (insoluble). Myosin and actin are the most abundant of myofibrillar proteins, which play an important role in muscle contraction, rigor mortis and cold shortening phenomena (Lawrie, 1985) which, in turn, influence the constitution and perception of sensory characteristics. Further, the palatability of meat is markedly affected by various cooking methods such as roasting, broiling, braising and degree of doneness. Meat products such as sausages, patties, loaves, nuggets, meat balls, *kababs*, *tandoori* etc., have their typical characteristics and a basic knowledge of their important attributes is necessary for sensory evaluation.

Sensory evaluation of foods including meat refers to their scientific evaluation through the application of human senses.

The important meat palatability attributes to be assessed are appearance, flavour, juiciness, texture and tenderness. These traits may be assessed both subjectively and objectively. Subjective quality evaluation relies on physical senses of the panelists. Both untrained (consumer) and trained (specialized) panelists should be able to significantly differentiate subjective quality parameters. However, several other factors such as pH, temperature etc., which have major impact on these attributes can only be determined by objective methods. A knowledge of these attributes is of prime importance. This paper discusses these aspects.

Appearance

Appearance is one of the important factors which influences the consumer's inclination, while buying the fresh as well as processed meats. It is basically the recognition and assessment of properties such as colour, surface structure etc., associated with the product. The shape of meat plays an important role in judging the appearance. So, it is advisable to make uniform slices or cubes for the sensory evaluation. The colour of fresh meat is determined largely by the concentration of myoglobin - the muscle pigment, which on oxygenation is converted to purple oxymyoglobin and on oxidation to brown metmyoglogin. It is the relative proportion of these pigments (myoglobin, oxymyoglobin, metmyoglobin), which determine the colour of fresh meat. The colour of fresh meat is species specific.

Appearance characteristics of both raw and cooked meat influence consumer's perception of safety and healthfulness. Consumers also relate colour to determine doneness in cooked meat products (Chambers and Bowers, 1993). Smulders (1986) opined that absolute colour scores cannot be provided through visual assessment, since it is extremely difficult for humans to develop a colour memory. However, Eddie *et al.*, (1990) observed that panelists could easily detect significant differences between colour and appearance of ham.

The pH of meat affects its colour and overall appearance. Pale, soft and exudative (PSE) pork is unattractive to consumers. Meat with high pH has better colour retention (Longlois, 1989). However, pH alone cannot predict the appearance of meat (Stonjanwoi and Flemming, 1988). Surface structure and overall shape of comminuted meat products have an important bearing on their appearance. Stevenson *et al.*, (1989) reported that panel colour scores were significantly correlated with acceptability (r = 0.97) and could be predicted from "CIEL a & b" values. Mechanically deboned meats have initially brighter colour which fades after some time (Nowakowski, 1985). Incorporation of vitamin E, as an antioxidant in ruminant diets, has been reported to prolong desirable colour (Faustman *et al.*, 1989). Further, Desmants and Cartier (1990) observed impairment of colour intensity on irradiation.

Flavour

Flavour is a complex sensation comprising mainly of odour and taste, odour being more important. It is sensed collectively by the oral and olfactory senses. There are four basic tastes viz., sweet, salty, sour and bitter. These basic tastes have their receptor taste buds or papillae on the tongue, and the upper palate. The sweet taste is most easily sensed at the tip of the tongue, the saline at the tip and edges, the sour at the edges and bitter at the back of the tongue.

The important meat palatability attributes to be assessed are appearance, flavour, juiciness, texture and tenderness.

Table 1. Some appearance parameters for meat studies

Parameters	Meat products
Degree of doneness	Hamburger patties
Appearance	Hamburger patties, Restructured steaks
Muscle colour acceptability	Beef steaks, Frankfurters
Colour	Turkey frankfurters
Overall appearance acceptability	Steaks
General appearance	Pork sausages

The papillae for bitter taste are especially deep, and so, the sensation takes longer to perceive and tends to linger (Jellinek, 1985).

Flavour is a complex sensation comprising mainly of odour and taste, odour being more important.

Odour is sensed at the regio olfactoria, which lies at the top of the inside of the nose. The odour constituents of the foods (meats) are frequently as well as strongly perceived by tasting rather than smelling. For sound odour perception, the sample should be smelt first, followed by tasting. In the oral cavity, the samples become warm, making the odour constituents more volatile. Of all the attributes, flavour has a profound effect on overall acceptability of meat product (Bartholomew and Osualo, 1986) with correlation coefficient of r = 0.89 (Kurtean, 1987). Flavour is a complex sensation of volatile components such as hydrocarbons, alcohol, aldehydes, ketones, esters, amines besides furans, pyrazines etc., (McLeod and Seyyedain-Ardebiei, 1981). These components are marked when meat is subjected to cooking. Fat and fat-soluble precursors have been shown to be implicated in accounting for species difference and contributing to meat flavour (Lawrie, 1985).

The flavour of meat is affected by many factors such as species, age, sex, pH, condition of storage, method of cooking and ingredients added in the processed meat. Schottyssek and Sailer (1986) observed the effect of slaughter age, sex, cut and presentation on the taste of

roasted broiler meat. They reported that overall sensory scores were better for females than males and for samples with skin than those without skin. Breast meat received a higher sensory score than thigh meat of male birds. Tauraille and Liu (1991) reported little effect of freezing on flavour of muscle, whereas Mitchell *et al.*, (1991) observed higher preference for unfrozen beef steaks than frozen with respect to flavour. However, Johnson *et al.*, (1990) found that intact beef steaks were higher in flavour desirability than comminuted restructured steaks. Staburvik (1989) studied the effect of cooking temperature on flavour of beef and reported clear and profound flavour for meat cooked at 55^0C than those cooked at higher temperatures. Longlois (1989) observed better flavour for meat with high pH than normal meat. Nowakowski (1985) reported that odour and taste of mechanically deboned meat were inferior to manually deboned meat.

Irradiation of comminuted meat products impairs the flavour which increases with the higher irradiation doses (Risvik, 1986; Desmants and Cartier, 1990). This irradiation deterioration may be attributed to lipid oxidation (GrozdonovaIatov *et al.*, 1990). The off-flavour, generally referred as "Warmed over flavour" in cooked meat, is probably caused by the oxidation of phospholipids of muscle by both heme and non-heme iron (Love, 1988).

Texture and Tenderness

British Standard Institution (1975) defined the texture as "the attribute of a substance resulting from a combination of physical properties and perceived by the senses of touch, sight and hearing. The physical properties include size, shape, number, nature and conformation of constituent structural elements". Thus, texture encompasses all properties of food, which are perceived by the kinesthetic and tactile senses in mouth e.g., tenderness, density, grannular structure, fragility, humidity etc. Brennan (1984) categorized the textural components of animal food as : (i) Mechanical characteristics which relate to the reaction of a food to stress e.g., hardness, brittleness, gumminess, chewiness, elasticity, cohesiveness etc., (ii) Geometrical characteristics which relate to size, shape and orientation of particles within meat e.g., coarseness, graininess, grittiness, fibrous, cellular etc., and (iii)

Meat texture is a function of the size of bundle of fibres into which the perimyseal septa of connective tissue divides the muscle longitudinally.

Other characteristics which relate to moisture and fat perception of the meat e.g., greasiness, oiliness, watery, dry, moist etc.

Meat texture is a function of the size of bundle of fibres into which the perimyseal septa of connective tissue divides the muscle longitudinally. The size of the bundle is determined by the number and size of muscle fibre (Lawrie, 1985). Texture and tenderness are complex sensations affected by many preslaughter factors like carcass grade, heredity, diet, age, sex etc., (Szczesnaik and Torgeson, 1965) and post-slaughter factors such as post-mortem glycolysis, fat deposition, connective tissue, muscle characteristics (size, extensibility, location and composition, muscle fibre, freezing, conditioning, cooking and processing of meats. Coarseness of texture increases with age and is greater in muscles of male animals. The thickness of perimysium around each bundle also contributes to the coarse texture of muscle (Lawrie, 1985). An indirect correlation between muscle fibre diameter and tenderness was reported by Hinter *et al.*, (1953). The large size of cattle in relation to sheep or pigs is generally associated with greater coarseness of their musculature. In general, increase in age decreases tenderness. Seildeman *et al.*, (1989) ranked beef muscles in order of increasing tenderness as Psoas major > Semi tendonosus > Longissimus dorsi >Biceps femoris > Semi membrinoisus. Tauraille and Liu (1991) reported small, but significant effect of freezing on tenderness, whereas both post- mortem deboning time and cooking methods have been reported to influence tenderness in poutry (Lyon and Lyon, 1990). In general, cooking of meat makes connective tissue more tender by converting collagen to gelatin. It coagulates and tends to toughen the protein of myofibril. Both these effects depend on time and temperature, the former being more important for the softening of collagen than the latter, which is more critical for myofibrillar toughening (Lawrie, 1985). The prolonged cooking time and relatively low temperature are thus justified for meat which has relatively more connective tissue. The tenderizing effect of prolonged cooking is in addition to that of ageing or conditioning. During braising, there is increased solubilization of collagen resulting in improved tenderness, whereas on roasting, there is relatively little softening despite higher collagen solubility (Paul, 1975). It has been reported that microwave cooking preferentially increases the solubilization of collagen (McCrae and Paul, 1974).

The overall impression of tenderness to the palate includes texture and involves 3 aspects,

which are initial ease of penetration of meat by the teeth, the ease with which the meat breaks into fragments and the amount of residue remaining after chewing. Sensory assessment of texture is usually done on the basis of the sensation perceived, when the meat sample is manipulated in mouth i.e., while biting, chewing and swallowing. During biting, teeth play an important role in the sensory evaluation of texture by their horizontal and vertical movements (Brennan, 1984). The degree of tenderness may be evaluated as the number of chews required to masticate the sample (Szczesnaik and Torgeson, 1965). The chew count helps the judges to focus attention on tenderness alone and to dissociate tenderness from other meat attributes, such as flavour and juiciness (Harrington and Pearson, 1962). The usual rate chewing is one chew per second although some panel leaders allow the judges to chew at rates most suitable for the individual (Szczesnaik and Torgeson, 1965). The standard size meat samples are generally chewed to the consistency at which meat is normally considered to be ready for swallowing. Hard palate also has an almost intact cellular surface, which is very sensitive to touch. Coarseness and other geometrical characteristics of food are sensored by receptors on this surface.

An idea about the textural characteristics of meats may be obtained prior to mastication. The visual appearancé of the sample may provide some idea about its firmness. When a sample of the solid meat is manipulated in the hand by pressing, bending, squeezing, cutting or penetrating with a fork, it gives an idea about its firmness, toughness, fibrousness or crispiness. The information about the viscosity, smoothness or stickiness of meat soup can be obtained by shaking, stirring, pouring or spreading them. These non-oral techniques have been used in fried bacon (Stanley *et al.*, 1980) and beef patties (Anderson and Lundgren, 1981). The sound emitted, when certain meat products are bitten and chewed, is to some extent a reflection of the texture of these products. This has been made use of in dehydrated products such as pork rind (Padda and Rao, 1984) and chicken skin snack (Sharma *et al.*, 1986). Theresults from the non-oral (tactile) tests were slightly more reproducible.

Objective or non-sensory methods are also employed for the evaluation of textural properties of meats. In general, 3 approaches are followed. The most common one involves the use of instruments to evaluate the physical properties of meat samples. Another approach is to examine the structure of meats and the third is to determine the chemical composition. The common principle employed in instrumental textural measurement is to allow a probe to come in contact with sample. The resistance offered by the sample before being deformed is noted and used as an index of the texture. The instrumental methods have been classified as empirical methods such as penetration test, shear test, compression test, extrusion test, cutting devices etc. Imitative methods having instruments to simulate the complex process of mastication to a limited extent, such as general food texturometer, volodkevich bite tenderometer and masticometer (Brennan, 1984) and the fundamental methods, which measure the well defined physical properties of the sample, such as Instron universal testing machine.

During biting, teeth play an important role in the sensory evaluation of texture by their horizontal and vertical movements.

Several studies of the sensory and objective evaluation for texture of meat have been conducted by various workers (Szczesnaik, 1968; Stanley *et al.*, 1980; Lyon and Lyon, 1990). Correlation of sensory evaluation with 11 instrumental methods for frankfurters have been carried out by Lee *et al.*, (1987). They found that the most discriminative instrumental parameters were compressive at failure, compressive force at 50% deformation without failure and maximum shear force. High correlations ($r > 0.80$) were reported between compressive force or shear force and sensory elasticity, firmness and chewiness. Klettner (1988) conducted comparative studies on evaluation of a sausage firmness by 3 instrumental techniques with Instron 1140 apparatus. S and R penetrometer and a Muller hardess testing device and sensory impressions of chewiness. The highest correlations were $r = 0.982$ for Instron breaking strength and $r = 0.981$ for Muller hardness testing device value. Eddie *et al.*, (1990) compared the sensory and objective determination of texture in Australian hams. They were able to discriminate various ham samples by both the methods.

Juiciness

Meat juiciness is an attribute having two organoleptic components. The first one is impression of wetness during initial chews, as a result of rapid release of meat fluid, the second being the sustained juiciness due to the stimulatory effect of fat on salivation. However, Beiken *et al.*, (1991) defined juiciness as the perceived amount of moisture released during mastication.

Good quality meat is more juicy than that of poor quality and the difference is partially attributed to the higher content of intramuscular fat in the former. Meat juiciness reaches minimum, when the pH level of meat is about 6. This may be due to greater ability of muscle proteins to bind water in this pH range. Tenderness and juiciness are closely related meat attributes. The more tender the meat, the more quickly the juices are released during chewing and more juicy the meat appears.

Tauraille and Liu (1991) found that frozen storage of meat had little effect on juiciness. However, beef held at -10^{0}C for 20 weeks was reported to be less juicy than beef held for a few days at 0^{0}C. Roast and grill from beef were more juicy even 24 hours after slaughter. Juiciness was greatest in the fresh frozen meat with high ultimate pH followed by dehydrated meat than meat of low ultimate pH, before or after freezing. Unfrozen beef steaks were preferable to frozen and thawed steaks with respect to juiciness according to Mitchell *et al.*, (1991). Addition of 30% connective tissue was reported to decrease juiciness of restructured beef roasts significantly (Liu *et al.*, 1990), whereas increased addition of back fat to the boneless hams improved the juiciness (Prusa *et al.*, 1989). Interestingly, addition of carrageenan at 0.5% along with 10% water could be successfully used to decrease the fat level of the formulation by 10%, while maintaining the same juiciness of the product (Egbert *et al.*, 1991). Cooking temperature had a profound effect on juiciness of meat. The degree of shrinkage on cooking was found to be directly correlated with loss of juiciness. For pork of a final frying temperature of 68^{0}C or even lower was reported to be most suitable from juiciness point of view (Fjelkner-Modig, 1986), whereas beef cooked at 55^{0}C was more juicy than one cooked at 60^{0}C to 75^{0}C (Stabursvik, 1989).

Mouth Coating

Mouth coating can be defined as the residue left coating the mouth after swallowing certain meat products. Young and Lyon (1973) noticed mouth coating in chicken frankfurters prepared from heat treated mechanically deboned chicken meat. They ascribed it to the addition of higher level of heated meat, which decreased the ability of meat proteins to satisfactorily bind the fat globules. This decrease would result in larger fat particles in frankfurters, which might have left a slight film in the mouth. They defined this attribute in their sensory panel sheet as existing in three degrees namely, very little, some and very much mouth coating an the basis of almost nil, detectable and excessive residue, respectively coating the mouth after swallowing.

Mouth coating can be defined as the residue left coating the mouth after swallowing certain meat products.

Krishnan (1988) and Anjaneyulu (1988) observed mouth coating in buffalo sausages and buffalo patties, respectively. They opined that this mouth coating in buffalo meat products may be due to higher fatty acid contents, which do not disintegrate completely during emulsion formation resulting in larger fat particles, which leave a film on the tongue and palate after swallowing. Krishnan (1988) also observed mouth coating in coarse ground buffalo sausages containing skeletal meat and buffalo kidney fat. He attributed this effect to high melting buffalo kidney fat. He, further, concluded that the overall acceptability score was predominently influenced by the mouth coating effect in such sausages.

Overall Palatability

It refers to the sensory perception of a meat product in totality. Though it is not a sensory attribute as such, it is of utmost practical importance because, it is the overall acceptability of a product in absolute terms, which actually matters. A meat product is not taken attribute-wise and so, a cumulative perception or the ultimate impression, which the product leaves on the sensory panelist is evaluated as overall palatability. It should not be taken as sum average of all the attributes, because some meat attributes influence the overall palatability of the product more than others. Data from Cross and Stanfield (1976) indicated that as tenderness increased, overall palatability of restructural steaks also increased. Lawrie (1985) has also rated texture and tenderness to be the most important eating quality attribute affecting the overall palatability of the product whereas Bartholomew and Osulao (1986) reported that compared to texture and appearance parameters, flavour had more effect on the overall acceptability of processed mutton products. However, for cooked chops, tenderness has been rated as the most important quality attribute influencing overall acceptability. Kurtean (1987) reported correlation of overall acceptability with aroma (r = 0.98) in beef semi-tendinosus muscle. Parrish *et al.*, (1991) observed that scores for tenderness, juiciness and flavour followed the same trends, as those of overall acceptance in steaks. A recent study on hot dog revealed that consumer perception of flavour,

chewiness and firmness influenced overall acceptability, whereas for turkey patties, consumer scores for juiciness more closely matched those for acceptability than scores for meatiness and firmness (Chambers *et al.*, 1992).

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Continued on page 36

Modified Atmosphere Packaging of Muscle Foods : Technology, Shelf-life and Safety Aspects

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Introduction

The terms "modified atmosphere" (MA) and "controlled atmosphere" (CA) mean that atmospheric composition surrounding a perishable product is different from that of normal air. Both MA and CA commonly involve manipulation of carbondioxide, oxygen and nitrogen levels. However, other gases such as carbonmonoxide, ethylene, propylene and acetylene are sometimes included. MA differs from CA, only in how precisely gas partial pressures are controlled, while CA is more precise than MA.

Use of modified atmosphere packaging (MAP) technology in meat industry had shown phenomenal increasing trend during the past two decades in various countries, especially in Australia, New Zealand, U.S.A., U.K. and many European countries. This commensurates with the increasing consumer demand of fresh and chilled meat without preservatives. MAP greatly extends the shelf-life of muscle foods under refrigerated storage and maintain colour, texture, sliceability and flavour of the product for a considerably longer time. Modified and controlled gas atmospheres have received attention for their potential benefit to maintain the quality of fresh and processed meats packaged in flexible films (Seideman and Durland, 1984).

The terms "modified atmosphere" (MA) and "controlled atmosphere" (CA) mean that atmospheric composition surrounding a perishable product is different from that of normal air.

History

The first practical use of modified atmospheres containing elevated levels of carbondioxide, as a preservative in the handling of fresh meat, was in the shipment of whole chilled beef carcasses from Australia and New Zealand to Great Britain in the 1930s. By 1938, 26% of the beef from Australia and 60% from New Zealand was being commercially shipped under CO_2 atmospheres. It is only during the 1970s that developments in the packaging materials and techniques had made this new technology both practically and economically feasible. A big turning point in MAP technology came in 1981, when Marks and Spencer Co in U.K. introduced a wide range of fresh meat products packaged under MA. The impetus behind these products came mainly from an increased consumer demand for preservative-free fresh and chilled products. There are numerous advantages of using MAP technology, but some basic problems involved, must also be considered. The advantages and disadvantages of MAP technology are listed in Table 1.

Vacuum packaging (VP) can delay the growth of aerobic spoilage micro-organisms and retard oxidation of lipids in fresh

Table 1 : Advantages and disadvantages of MAP technology

I. **Advantages**
- Extended transit time.
- Active inhibition of bacteria, mould and fungus and post-harvest respiration.
- Potential shelf-life increases by 50 to 400%.
- Products can be distributed over longer distances and with fewer deliveries leading to decreased distribution costs.
- Reduced economic loss.
- Provides a high quality product.
- Easier separation of slices (e.g., vacuum, packaged vs MAP bacon).

II. **Disadvantages**
- Visibly added cost.
- Variable product requirements i.e., different gas formulations needed for each product types.
- Not universally effective.
- Temperature control necessary.
- Atmosphere maintenance.
- Special equipment and training.

meats (Genigeorgis, 1985). However, disadvantages such as deformation of cuts by film tightening, temporary and unsightly discolouration (Grau, 1983) and weight losses from purge (Zarate and Zaritzky, 1985) have prevented widespread vaccum packaging of retail cuts.

Use of appropriate gas mixtures for MAP offers an alternative to VP. Gases most commonly used in MAP are oxygen, carbondioxide and nitrogen, usually in combinations. In gas mixtures containing high concentrations of oxygen, the meat myoglobin is readily oxygenated to give a desired bright red colour of fresh meat (Seideman and Durland, 1984). However, such atmospheres cause enhanced growth of aerobic microorganisms and development of oxidative rancidity in meat, thus decreasing shelf-life (Cole, 1986). Moreover, high proportions of oxygen (i.e., more than 50%) constitute serious industrial and transportation fire hazards. Carbondioxide in high concentration has been shown to inhibit spoilage bacteria in red meats (Gill and Penney, 1988). Carbondioxide - induced discolouration of red meats is still controversial. Nitrogen is used commonly as a filler gas to balance MAs and is generally considered inert to meat quality. The nitrogen gas (100%) in the packaging of frankfurters has been shown to inhibit the growth of yeasts and moulds and to reduce greening and off-odour in the product (Simard et al., 1983).

More recently, the captech process has proven to be most promising for chilled meats. This system relies upon the integration of hygienic processing, optimum storage temperature (-1.5^{0}C), low residual O_2, high concentration of CO_2 and gas inpermeable packaging films. The captech process has been applied to extend the storage life of venison, beef, pork and lambs for periods approaching 6 months (Gill, 1990). Also, commercial application is evident in the sea shipment of chilled New Zealand lamb to North American markets (Gill, 1990). Low temperature storage of pork in CO_2 has prolonged shelf-life to 2 to 3 months and the captech process has further extended the quality to 5 - 6 months (Gill and Harrison, 1989).

Another method called "master park", is more commonly used for MAP of fish. In this type of packaging, the fish product is first overwrapped with PVC film and is then placed in a large partial barrier film, master pouch bag that has usually been flushed with CO_2. Prior to retail display, the consumer package is taken out of the master package and once removed, has a shelf-life of approximately 3 to 4 days (Brody, 1989).

Modified Atmosphere Technology

Several distinctions can be drawn in discussing atmosphere technology. In CA systems, the selected atmosphere concentrations of gases are maintained throughout the storage process, whereas in MA systems, only an initial charge is made, consistent with the expected requirements of the commodity and transportation duration. Dynamic changes due to gas permeation, leakage, absorption, and/or biochemical conversion via respiratory activity must be considered in both the systems. In many instances, CA is technically superior to MA, but often it is not sufficiently advantageous to balance the lower cost advantage of MA, resulting from the latter's less complex mechanical requirements.

Oxygen partial pressures

can be reduced by purging with nitrogen, burning, using catalytic converters or using silicone membranes. Water, lime and molecular sieves are found to be effective scrubbers for removal of CO_2. Pressurized cylinders or dry ice can be used for addition of CO_2 into the holding chambers. Carbonmonoxide can also be added from pressurized cylinders.

In commodity-modified atmospheres, an actively respiring and metabolizing product reduces the oxygen and increases the carbondioxide in the ambient air within a chamber in which various barriers and restrictions to gas exchange exist. Various techniques used to accomplish desired commodity-modified atmospheric conditions include waxes and other surface coatings, plastic covers with diffusion windows, manipulation of shipping containers and vehicles, pallet shrouds, polyethylene liners in shipping containers, packaging in film wraps or bags and air- tight cold storage rooms.

Equipments and Films for MAP

The success of MAP technology depends upon the use of proper packaging films and equipment. A number of films are available, but considerations for the choice lie with the machinery and system being used for packaging rather than the type of food involved. Machines used in U.K. for gas flushing are adapted vacuum machines, manufactured by Multivac and Swissvac. Vacuum packaging machine manufactured by Roschermatic (Germany) is also commonly used.

Meat requires different conditions for packaging, while beef needs high oxygen content to maintain a bright brick-red colour, which is popular among the customers. Chicken in comparison needs little oxygen and reduced amount of carbondioxide, which can flavour the meat. Pork with its high fat content needs less oxygen and some nitrogen for glow. In general, the packaging films should have good barrier and sealability properties and must have optimum clarity and anti-fogging properties so that packs maintain their clear appeal in or out of the chill display. The various types of packaging films used for MAP of different meat products are presented in Table 2.

CA is technically superior to MA, but often it is not sufficiently advantageous to balance the lower cost advantage of MA, resulting from the latter's less complex mechanical requirements.

Effect of Gases on MAP Foods

Oxygen, nitrogen and carbondioxide are the three main gases used commercially, although trace gases such as carbonmonoxide, nitrous oxide and sulphurdioxide are mentioned as possible gases for MAP of foods.

(i) *Effect of oxygen (O_2) :* One of the major functions of O_2 in MAP meats is to maintain the meat pigment, myoglobin in oxymyoglobin state responsible for the bright red colour, which most consumers associate with fresh meat. Tissue foods utilize oxygen by respiration, oxidation or microbial action. O_2 stimulates the growth of aerobic bacteria and inhibits the obligate anaerobes. Lowering oxygen level in MAP environment helps in extending the shelf-life of this product by reducing metabolic and chemical oxidation rates, but it can stimulate the outgrowth of anaerobic pathogens (Jones, 1989). Restricting oxygen will generally retard the growth of *Pseudomonas*, while enhancing

Table 2. Packaging films used for MAP meat products.

Type of film	Product
Curlon 863 (Nylon/curpolymer-Surlyn)	Beef rib eye rolls of 1 inch thick
Nylon-Polyester vacuum bags B540, Cryovac, W.R. Grace	Ground beef
Saran coated PVC bags	Beef strip loins
PA80/PE100-PE 100/PA80/PE100	Smoked pork loin
Mylothene 12/80/S	Sausages
PETP/X/PE/X, 12/5/70/5 laminated plastic bags	Fresh pork chops
Thermoformed plastic pouches (lower part PVC/PE, 250/70 and cover PETP/X/PE, 12/5/70	Processed ham
Cryovac barrier bags	Ground beef patties
Foil laminate pouches	Boneless pork loin

the growth of *Lactobacilli* or *Brochothrix*.

(ii) *Effect of nitrogen (N_2) :* Nitrogen is an inert tasteless gas, which displays little or no anti-microbial activity of its own. Because of its low solubility in water, the presence of N_2 in MAP food can prevent pack collapse that can occur, when high concentration of CO_2 is used. In addition, N_2 by displacing O_2 in the pack can delay oxidative rancidity and also inhibit the growth of aerobic microorganisms.

(iii) *Effect of carbon-dioxide(CO_2) :* Carbondioxide is both water and lipid-soluble. It is mainly responsible for bacteriostatic effect on the microorganisms found in MA environment. The gas selectively inhibits the growth of gram negative bacteria, such as *Pseudomonas* and related psychrotrophs, which grow rapidly and produces off-odours and- flavours in raw meat and poultry. Lactic acid bacteria, such as *Streptococci* and *Lactobacilli* are less affected by elevated levels of CO_2. The level of CO_2 that gives maximum inhibition of the common spoilage organisms is 26% CO_2 in air.

There have been many theories regarding the mechanisms by which CO_2 acts on bacterial cell, which include alteration of intracellular pH, disruption of the internal enzymatic equilibria (interfere with dehydrogenating enzymes of the cells), enters mass action equilibria for enzymatic decarboxylation, changes in cell membrane functions and consequently, nutrient uptake and absorption, affecting the physico-chemical properties of proteins and toxicity of carbonic acid in its undissociated form (Farber, 1991).

For maximum anti-microbial effect, the storage temperature of a MAP product should be kept as low as possible, because the solubility of CO_2 decreases dramatically with increasing temperature.

MAP Foods Commercially Available

In North America, the foods being packaged under MAP include fresh raw meats (sliced bacon, steak; beef hearts, pork kidneys, ox tails); cooked meats (hamburgers, beef jerky, sausage rolls, sliced meats, cretons or head cheese, wieners); Poultry (whole carcass, nuggets, peeled hard cooked eggs); cheese, prepared salads, pasta and in Canada, the commonly distributed MAP foods are fish and various types of sandwiches. The expected shelf- life of most of these products is 1 to 2 months. The atmospheric conditions, under which a wide variety of foods have been stored, are given in Table 3.

Oxygen, nitrogen and carbondioxide are the three main gases used commercially, although trace gases such as carbon-monoxide, nitrous oxide and sulphurdioxide are mentioned as possible gases for MAP of foods.

Effect of MAP on the Quality of Fresh Meats

1. *Red meats :* Carbondioxide alone or in combination with oxygen extend the shelf-life of meats. For fresh meat in which red colour maintenance is important, 60 to 80% oxygen is generally used so that formation of metmyoglobin, which is responsible for undesirable brown colour of

Table 3. Gas mixtures used in MAP products (Farber, 1991)

Product	% CO_2	%O_2	% N_2
Fresh meat	30	30	40
	15-40	60-85	-
Cured meat	20-50	0	50-80
Sliced cooked roast beef	75	10	15
Eggs	20	0	80
	0	0	100
Poultry	25-30	0	70-75
	60-75	5-10	≥ 20
	100	0	0
	20-40	60-80	0
Pork	20	80	0
Processed meats	0	0	100
Fish (white)	40	30	30
Fish (oily)	40	0	60

meat, is retarded. CO_2 is generally used in concentration ranging from 15 to 40%. Optimal inhibition of meat spoilage bacteria is achieved at 40 to 60% CO_2. But at a higher concentration, CO_2 causes discolouration of meat due to denaturation of meat proteins. Carbondioxide (20 to 30%) or even 10%, may be sufficient to retard bacterial growth (Siedeman and Durland, 1984).

The quality changes of beef rib eye steaks stored in different modified atmospheres at 2-4^{0}C were studied by Fu *et al.* (1992). They concluded that vacuum packaging produced steaks with highest overall acceptability and protected colour and lipids against oxidation, while modified atmospheres were more effective in prolonging shelf-life, reducing purge value and increasing cooking yield of steaks. Anjaneyulu and Smidt (1986a) concluded that fresh pork chops had acceptable odour upto 9th day stored in air, N_2 and N_2O, upto 13th day in vacuum and high vacuum packed samples and even upto 16th day for CO_2 - enriched packs. N_2 or N_2O did not inhibit the rate of bacterial growth.

Display alone resulted in lipid oxidation of lean ground beef samples. Brewer and Wu (1993) reported that loss of red colour was greatest in PVC packaged samples and they also observed that during frozen storage of above samples, vacuum packaging was the most protective for most characteristics studied. The type of gas and film pouch used in MAP of frozen (IQF) turkey strips influenced its organoleptic quality (Ray *et al.*, 1993).

Many workers had studied the microbiological quality of meat stored under MAs. Depending upon storage temperature and gas mixtures used, the shelf-life of beef, pork and lamb varied from 2 to 8 weeks (Farber, 1991). In atmospheres composed of 20% O_2 (similar to air) plus 20 or 40% CO_2, total bacterial numbers on beef steaks did not reach log 7.00, until 5 weeks of storage at 2- 4^{0}C (Fu *et al.*, 1992). Superior performance of high CO_2 atmosphere over vacuum packaging was due to marked inhibition of some pathogenic psychrotrophs, belonging to *Enterobacteriaceae* e.g., *Yersinia enterocolitica* (Mafu *et al.*, 1989). A shift from an initial gram negative aerobic spoilage flora to a predominantly gram positive facultative anaerobes, especially *Lactobacillus* species occurs during MA storage of beef (Rousset and Renerre, 1991) and pork loin (Greer *et al.*, 1993).

Fresh meat cuts when treated with phosphate, ascorbic acid or ascorbate and citric acid or citrate and packaged in MA containing CO_2 and O_2 in a critical ratio, retained fresh meat colour for 20 days and delayed microbial spoilage.

The various technical points and precautions to be followed during the storage life of vacuum packaged and CO_2 CAP of chilled meat for export purposes (Judd, 1993) and for supermarkets (Woods, 1988) have been described. Meat pH was found to be an important factor influencing the shelf-life (total counts, coliform counts) and weight loss of meat during processing and storage period in the vacuum packs (Benes *et al.* 1990). Oxygen-free packaging (less than 0.1% O_2) of retail meat cuts, using natural meat enzymes or by incorporating a catalytic system and storing at 0-2^{0}C even upto 3 to 4 weeks had lower drip loss and better red colour of meat (O' Keeffe, 1988), Beef and lamb cuts stored in an atmosphere containing 80% O_2 and 20% CO_2 at 5^{0}C had a storage life of three times more than those kept in conventional over wrap trays (Shay and Egan, 1990). Fresh meat cuts when treated with phosphate, ascorbic acid or ascorbate and citric acid or citrate and packaged in MA containing CO_2 and O_2 in a critical ratio, retained fresh meat colour for 20 days and delayed microbial spoilage.

Trigon packaging system (U.K.) Ltd. and Marks and Spencer jointly developed a new bulk package for fresh meat cuts, combining vacuum skin packaging (VSP) with modified atmosphere packaging (MAP) to retain bloom of beef steak, pork chops and lamb chops and extend their shelf-life. In this process, individual meat cuts are first vacuum skin packaged in permeable 3-ply co-extruded film and then bagged in preformed nylon pouches (with a polyethylene sealant layer) injected with a gas blend of 80% O_2 and 20% CO_2 and sealed (Anon, 1989). In the similar line, United States patent developed by Williams (1989), consisted of a peelable O_2 barrier layer inside where remains a O_2 permeable skin layer enclosing the product. Minced beef when vacuum packaged in the presence of solid CO_2 maintained its bloom and had reduced total microbial numbers during storage and display (Madden and Moss, 1987). Irradiation combined with MAP had little scope for beef primal cuts, whereas it improved the sensory and microbial quality of pork, mutton, sliced luncheon meat and poultry meat (Patterson,

1990).

2. *Poultry meat :* Earlier research in 1970s by various workers had established that the shelf-life of MAP chicken carcasses/pieces had 2 to 3 times more than air-packed counterparts. Halved ready-to-cook chicken carcasses stored under CO_2 had shelf-life of 26 days (Bohnsack *et al.*, 1988) and frozen (IQF) turkey strips stored in MAP (Ray *et al.*, 1993) upto 84 days had highest sensory scores in respect of aroma, appearance and structure. Increased levels of CO_2 were synergistic with the lethal effect of irradiation of fresh minced chicken (Grandison and Jennings, 1993) and increased its shelf- life. For a shelf-life of 28 days of ground chicken meat, it was necessary to apply CO_2 concentration of 60 to 80% (Baker *et al.*, 1985), while under the same concentration of CO_2, the shelf-life of chicken quarters extended to 35 days at 2^0C (Hotchkiss *et al.*, 1985).

3. *Fish :* The three major modes by which fish can be stored in MAP environments, enriched with CO_2 are large van, master pack and individual consumer package (Farber, 1991). The shelf-life of MAP fish is substantially increased as compared to air control at the same temperature. Generally, CO_2 - MAP provides for consistently improved stability of fresh fish. Yao- Wen Huang *et al.*, (1993) showed that vacuum skin packaging (VSP) of weakfish significantly reduced lipid rancidity development and retarded lipid hydrolysis as compared to traditional overwrapping.

Effect of MAP on the Quality of Process Meats

Information regarding factors affecting the quality of ready-to-eat MAP meals, cured meat products and packaging requirements is available. Use of MAP for a range of meat products viz., mortadella, sausages, salami and pipperoni slices due to their advantages of shelf-life extension, separation of meat slices and attractive product appearance is described (Landa, 1989).

Nitrogen backflush produced the lowest purge value than that of vacuum packaged controls and CO_2 treatment yielded better taste panel scores of MAP ground beef patties during frozen storage (Bentley *et al.*, 1989). MAP (80% N_2/20% CO_2) of ground beef patties gave better colour and decreased weight loss by exudation over VP counterparts during storage at 36^0F (Mc Millin *et al.*, 1990). Roast beef was still acceptable after 28- 35 days and hamburger only after 14 days storage at 4^0C packed in gas impermeable film with 50% CO_2 and 50% air. But exclusion of O_2 extended storage life of hamburger from 14 to 35 days (Mc Mullen and Stiles, 1989). An atmosphere containing 75% CO_2, 15% N_2 and 10% O_2 was the most effective in simultaneously inhibiting *Clostridium perfringens, Salmonella typhimurium, Staphylococcus aures* and *Pseudomonas fragi* (Hintlian and Hotchkiss, 1987) in roast beef. The pH and lipid composition of pre-cooked pork and turkey under CO_2 and N_2 storage changed little, but moisture content had decreased after 3 months at - 20^0C. VP turkey was darker and redder than other samples (Nolan, 1988).

Dip treatment in a solution containing 70% ethanol, 3% L-ascorbic acid and 0.08% DL-tocopherol and MAP in 20% CO_2 + 80% O_2 of beef loin steaks retained acceptable surface colour throughout the storage period of 13 days at 4^0C and had least variation of pH and TBA values (Okayama, 1987). VP dried beef was acceptable in terms of sensory and microbial quality during storage at 32-33^0C for upto 6 weeks (Arganosa and Ockerman, 1988). CO_2 flushing and packaging under slight overpressure had been found to eliminate discolouration, caused by photo-chemical pigment degradation of VP sliced ham (Andersen *et al.*, 1990). The bacterial counts and colour of the processed ham packed in 35% CO_2 + 65% N_2) remained more or less same during the entire storage period of 30 days at 3-5^0C (Anjaneyulu and Smidt, 1986b).

Safety Concerns of MAP Muscle Foods

Considerable interest in CAP/MAP muscle foods has resulted in extended shelf-life refrigerated (ESLR) foods and has become a new area of concern for food microbiologists. Despite the increased shelf-life of the above foods, Food and Drug Administration expresses concern that if proper controls are not in effect, some *sous vide* foods may pose a potential public health hazard (Rhodehamel, 1992). The concerns involved microbiological safety of these products. On principle, low oxygen and high CO_2 levels in MA environment induce lengthening of lag phase/or log phase (generation time) of aerobic spoilage organism. On the other hand, it gives chance to the growth of anaerobic pathogens. In the past, psychrotrophic non-proteolytic strains of *Clostridium botulinum* had been the major safety concern associated with MAP foods. However, new concern, have been raised with some of the newly recognised psychrotrophic pathogens such as *Listeria monocytogenes*, which may grow well in refrigerated MAP products. Effect of MAP on growth and survival of food-borne pathogens are outlined below.

The most common types

of *Clostridium botulinum* causing human illness are A, B and E. They produce neurotoxin. Kautter *et al.*, (1981) reported that *Cl. botulinum* could produce toxin in nitrogen packed hamburger sandwiches at 12^0C, but not at 8^0C and also toxin was not produced in turkey or sausage sandwiches. So, keeping the storage temperature as low as possible is quite important. In MAP fish products under certain conditions of temperature abuse or even at 4^0C under anaerobic MA *botulinum*, toxin can be detected well before organoleptic deterioration (Post *et al.*, 1985). So, National Academy of Sciences in U.S. has recommended not to store VP/CAP fish products at refrigerated temperature.

Another culprit *Yersinia enterocolitica* which causes gastrointestinal disorders and arthritis in man, can grow in high pH beef packaged under 100% CO_2 at 5 and 10^0C temperature, but unable to grow at 0, 2 or -2^0C (Gill and Reichel, 1989). However, this organism was not able to grow in minced beef at 4^0C in a MA of 20% CO_2 and 80% O_2 (Kleinlein and Untermann, 1990).

Recently, much attention is paid to *Listeria monocytogenes* by many research workers. It affects mainly pregnant women, foetuses, new borns, the elderly and immunodeficiency subjects. It is a very hardy organism, psychrotrophic pathogen, can grow in cook-chill MAP products and appears to be more heat tolerant. The disease *listeriosis* is associated with high mortality rate. These organisms grow in CO_2 - packed beef at 10^0C and VP beef at 0, 2, 5 and 10^0C (Gill and Reichell, 1989), but they do not survive well in raw minced chicken in MA containing 75% CO_2 and 25% N_2. However, if 5% O_2 is added, the bacteria can grow even at 4^0C (Wilhelm, 1982).

Furthermore, the pathogens capable of growing between 5-12^0C in MAP products due to temperature abuse are *Salmonella spp, Clostridium perfringens, Bacillus cereus, Staphylococcus aureus and Vibrio parahaemolyticus* (Palumbo, 1986). Besides, refrigerated conditions may allow *Campylobacter jejuni* and *Brucella* Spp to survive for longer periods.

MAP can be used to extend shelf-life and to maintain high quality in the marketing channels for considerably longer time.

Another potent pathogen, *Escherichia coli* 0157 : H7 strain has caught to the attention of food microbiologists. Ground beef, pork chop, chicken, turkey, lamb and even unpasteurized milk are the most important sources of infection by the above pathogen. It causes bloody diarrhoea and renal failure in humans. None of the gas mixtures tested ($CO_2/O_2/N_2$: 0/5/95, 0/10/90, 5/10/85, 5/20/75, 10/5/85 and 10/20/70) significantly affected growth of the bacterium at 5, 10 and 20^0C (Hao and Brackett, 1993). They also observed that MA did not significantly affect the tolerance of *E. coli* 0157 : H7 to 3% NaCl. The *E. coli* grew at 10 and 20^0C and survived at 5^0C.

The success of MAP technology depends upon initial products quality, hygienic slaughtering of food animals, correct packaging material and equipment, correct gas mixtures to be used and strict control of temperature.

In spite of the above potential hazards, there is nothing to fear in consuming MAP products, unless the product is temperature abused, because sufficiently high numbers of pathogen(s) must be ingested to cause illness. Therefore, strict adherence to temperature control must be mandatory not only for MAP food processors, distributors and retailers, but also for the consumers.

Cost Benefit Relationship

Though attention to good temperature control of MAP/CAP products is essential, the achievable benefits can be well worth it. One of the most important benefits is that the MAP commodity being transported can result in better handling throughout the distribution chain, augmenting the returns available from use of MAP. MAP can be used to extend shelf-life and to maintain high quality in the marketing channels for considerably longer time. Various methods for employing MA e.g., rail cars, sea vans, pallet-in-a-bag, bag-in-a-box, portion bags and *insitu* MA generation and related cost of the product had been reported (Wolfe, 1980). Loss/value relationship of the commodity justifies the use of MA. Valuable products such as meat and fish easily justify MA costs.

Conclusion

The success of MAP technology depends upon initial products quality, hygienic slaughtering of food animals, correct packaging material and equipment, correct gas mixtures to be used and strict control of temperature. It should be remembered that CAP or MAP is not a substitute for good sanitation. When spoilage organisms are low in MAP products, pathogens grow due to lack of competitors in case of temperature abuse. In such situations, additional hurdles/barriers, such as use of lactic acid starter culture, water activity, competitive flora and redox potential may be of great use in MAP foods in future. These hurdles may interact directly or synergistically to maintain microbial stability of a particular product. Further research is required in microbiological safety concerns (potential health hazards) of MAP foods. Although there is a fair chance to abuse MAP foods in this regard, there have been no reported illness of foodborne diseases linked to the consumption of these products. Cost involved in MAP food is superceded by its high quality maintained for long time. So, by conducting necessary research in future, a wide variety of new MAP products will be evolved by regulatory agencies for its wide marketing to meet the increasing consumer demand for fresh meat products without any harmful preservatives.

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Sensory Attributes of ..... *Continued from page 27*

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Tumbling and Massaging - An Emerging Technology for Meat Industry

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Introduction

Extensive research revealed greater potential and promise for application of Tumbling and Massaging in meat industry world over. This important advancement started in 70's, as a process of Massaging meat after injection with brine (Viskas, 1974). However, tumbling was originally developed in Europe for production of boiled ham (Michels 1976). Americans advanced the processing technologies and areas of tumbling utilization (Motyoka *et al.*, 1981). Meat processors can use this processing technique to increase production and turn over rates as well as the economic savings with reduced time and refrigeration costs (Marsh, 1977). The product developed has got enhanced meat binding, external appearance, sliceability, taste and yield.

What is "Tumbling and Massaging" ?

Western meat Industry has used tumbling to include both tumbling and massaging, (Weiss 1973 ; Rust and Olson, 1973). Tumbling involves the influence of impact energy on the muscle tissue, which occurs when meat falls from the upper part of a rotating drum or can be caused by striking the meat with paddles or baffles. On the other hand, massaging is a less physically rigorous process and involves frictional energy resulting from rubbing of one meat surface on another and on the smooth surface of a container (Krause *et al.*, 1978a) or by placing them in a vat,where they are knoded by means of rotary mixing unit, which forces the muscle chunks to rub against each other and to sides of the tub resulting in transfer of frictional energy on the surface of meat.

Tumbling involves the influence of impact energy on the muscle tissue, which occurs when meat falls from the upper part of a rotating drum or can be caused by striking the meat with paddles or baffles.

The basic goal of massaging process is to develop protein-rich exudate without gross physical damage to muscle chunk (Theno *et al.*, 1978a), during heating for the development of restructured products. Weiss (1973) and Krause *et al.*, (1978b) deduced that the primary aim of massaging and tumbling is, a) to produce enough protein exudate (consisting mainly of salt-soluble proteins, actin or myosin) to effectively promote cohesion during thermal processing, b) to enhance tenderness, c) to enhance juiciness d) to develop desirable slicing characteristics and e) to enhance the curing process with attractive and uniformly developed cured meat colour.

Mechanical agitation with tumbling and massaging alter the muscle structure and aid in extraction and solubilization of salt-soluble proteins (SSP), which bind meat pieces into one solid uniform piece during cooking (Cassidy *et al.*, 1978). As the time of physical manipulation increases the amount of myosin

extract increases, significantly (Solomon and Schimidt, 1980). Tumbling, in fact, causes cellular disruption in muscle tissue by utilizing the kinetic energy of meat piece falling inside a rotating drum. The results of such cellular disruption are improved yield, tenderness, cohesiveness and cure distribution (Weiss, 1973 : Krause *et al.*, 1978a ; Ockerman *et al.*, 1978 ; Addis and Shanus, 1979).

Massaging process serves to disrupt the normal muscle structure through the application of frictional energy creating a greater surface area from which greater amounts of myofibrillar proteins may be extracted. These solubilized proteins are thought to be released either through extraction from muscle cells or cellular destruction, resulting in release of intracellular material into the exudate (Theno *et al.*, 1978a). The exudate is not only exclusively composed of solubilized myofibrillar proteins, it also contains fat, water and pieces of broken muscle fibre (Hansen, 1960 ; Rehelic *et al.*, 1974 ; Siegal *et al.*, 1978). The protein-rich exudate has been shown to be highly concentrated between muscle pieces in chunk type products (Schnell *et al.*, 1970; Vadehra and Baker, 1970). Exudate developed by massaging process serves as a heat set adhesive between the muscle chunks (Theno *et al.*, 1978c) and binds the meat chunks together (Schnell *et al.*, 1970 ; Vadehra and Baker, 1970). This exudate acts as a sealer, when thermally processed, thus facilitating the moisture retention in the meat product (Rust and Olson, 1973).

Massaged meat holds higher salt and low water content than non- massaged meat, which plays an important role in influencing the properties of myofibrils. These properties of myofibrils may be one of the major contributors for better tenderness of massaged meat (Cook, 1967 ; Chaudhry *et al.*, 1969 ; Rejt *et al.*, 1978).

Histological Studies

Histological studies conducted by Rejt *et al.*, (1978) and Theno *et al.*, (1978b) to study the effect of massaging on muscle tissue, revealed that massaging increased intracellular space, causing clearly observable changes in surface layer of meat, which led to conspicuous damage to the structure of muscle cells (disruption) and fragmentation of cell groups. Intensity of the above effects was less in deeper layer of massaged meat, whereas the surface layer resembled the structure of crushed meat which produced changes in physico-chemical properties (Sherman, 1961). Extensive massaging for 24 hr caused massive fibre disruption and loss of normal integrity. The effect was more pronounced in the presence of salt and phosphate (Theno *et al.*, 1978b,c). As such, massaging for 4-8 hr with adequate salt and phosphate can produce sufficient exudate required for optimum quality. Such 4 hr massaging develops areas of aline protein, which forms a binding matrix between muscle chunk and myofibrils. The fibrils are disrupted to the extent, where protein extraction can take place (Theno *et al.*, 1978c). Emulsion-like areas which possess histological characteristics are also developed similar to those of true emulsion meat such as frankfurters and bologna (Cassens *et al.*, 1975). Further, tumbling with 2% added salt was found to have higher percent free water than higher salt concentration (Ockerman and Wu, 1990).

Mechanical agitation with tumbling and massaging alter the muscle structure and aid in extraction and solubilization of salt-soluble proteins (SSP), which bind meat pieces into one solid uniform piece during cooking.

Massaging process serves to disrupt the normal muscle structure through the application of frictional energy creating a greater surface area from which greater amounts of myo-fibrillar proteins may be extracted.

The Processes

Tumbling or Massaging of meat is a relatively new process for improving the quality characteristics of cured meat (Mass, 1963; Weiss, 1973 ; Rust and Olson, 1973 ; Rehelic *et al.*, 1974; Theno *et al.*, 1977). These processes have been reported to aid in the uniform distribution of curing ingredients, increase extraction of salt-soluble proteins, improve the binding effect, the colour development and reducing the time required for development of cured colour (Viskas, 1974 ; Krause *et al.*, 1978a, Ockerman *et al.*, 1978). It has a significant influence on external appearance, internal colour, sliceability, taste, yield and aroma (Krause *et al.*, 1978b ; Mills *et al.*, 1980). A linear

relationship between tumbling and cellular disruption, binding strength, cohesion, tenderness, colour distribution and cooked yield has been reported (Lawlis *et al.*, 1992).

During normal curing operation, the brine movement may be due to osmotic pressure alone. However, when tumbling is applied, the distribution of curing ingredients is not only by osmotic pressure, but also due to movement of muscle tissues by disruption of muscle sarcolema.

Massaging improves cooking loss by about 50% than control (Rejt *et al.*, 1978). This may be, as a result of loosening of muscle structure, which facilitates penetration of curing salt deeper into the muscles, which have been influenced by water holding capacity (WHC), both in respect of water bound by hydration centres and the so-called capillary water (Acton, 1972a, b ; Rejt *et al.*, 1978). Massaging also has the advantage of decreasing the processing time compared to non-massaged part (Booren and Mandigo, 1987).

Two basic methods of tumbling treatments are intermittent and continuous tumbling. Intermittent tumbling allows for a rest period within each hr of tumbling cycle (Krause *et al.*, 1978a). The rest period of intermittent tumbling allows the curing solution to migrate and diffuse more uniformly throughout the tissues and enhances solubilization of the salt-soluble proteins. Krause *et al.*, (1978a) found that 18 hr intermittent schedule results in significantly better yields than that of a continuous 3 hr tumbling cycle. Krause *et al.*, (1978b) have noticed that shorter tumbling period (3 hrs) may result in cure movement and protein extraction sufficient to result in acceptable quality. However, the improvement in yield caused by development of surface moisture barrier of exudate requires longer period of tumbling interrupted with sufficient rest period to permit the movement of the salt-soluble proteins. Further, Ockerman *et al.*, (1978) have reported that short tumbling of 30 min may produce soft, pliable pork tissue with creamy, tacky exudate on the surface, but this 30 min tumbling was not sufficient to increase texture, yield or sensory characteristics.

Tumbling or Massaging of meat is a relatively new process for improving the quality characteristics of cured meat.

Tumbling of pre-rigor muscle tissue can substantially reduce processing time without affecting the quality of finished product (Sefton, 1983). Tumbling also reduced pH decline in pre-rigor muscle possibly due to cellular disruption (Cassidy *et al.*,1978). Enhanced distribution of cure and salt during tumbling may retard enzymatic action necessary for glycolysis and production of lactic acid than non-tumbled meat, thereby inhibiting rigor mortis (Plimpton *et al.*, 1991). Tumbling has been reported to have a quadratic effect on pH value, as tumbling time increases, rate of pH decline decreases (Lawlis *et al.*, 1992).

The global trend in development of meat industry is the production of low fat meat products.

Bedinghaus *et al.*, (1992) found that 3 hr intermittent tumbling was sufficient to produce pre-rigor or post-cured ham. They further concluded that intermittent tumbling of pre-rigor or post-rigor meat beyond 3 hr has no additional benefits. Lawlis *et al.*, (1992) have suggested that pre-rigor electrical stimulation can produce cellular disruption, and increase salt-soluble protein extraction (upto 180 volts). Therefore, an acceptable product can be produced with reduced tumbling time (3-6 hr) after electrical stimulation.

Processing pork bellies with multi-needle injection machine was facing difficulties to meet USDA regulations for residual nitrosamine level (Dudley, 1979). Tumbling process may help to reduce the residual nitrosophyrolidine level within acceptable USDA standards (Motycka, *et al.*, 1981). On the contrary, increase in residual nitrite content has been reported by Krause *et al.*, (1978a).

Tumbling was the most effective in producing highly acceptable finished product, if the ham was trimmed to not more than three mm of fat cover, thereby improving appearance, sliceability and yield of leaner products compared to fat cover (Krause *et al.*, 1978b). The thickness of fat cover and presence of additional qualities of intramuscular fat could prohibit the proteins from reaching the surface of tissue, and therefore, a leaner trim is more suitable, as there will be greater available source of proteins for extraction.

Conclusions

The global trend in development of meat industry is the production of low fat meat

products. Reducing fat content with added water remaining constant, the product becomes firmer, more rubbery, less juicy and darker in colour (Decker *et al.*, 1986; Hand *et al.*, 1987). The physical manipulation y massaging could be an alternative for improving water binding and protein to protein interaction in low fat sausage type products (Claus *et al.*, 1990), as massaging has an advantage of not only decreasing processing time, but also to produce product with uniform colour, texture, fat distribution and improves binding quality (Siegal, *et al.*, 1978 ; Booren and Mandigo, 1987).

Claus *et al.*, (1990) found that intermittent massaging of meat for 5 hr was not sufficient for improving the binding characteristics and cooking loss, although it slightly reduced the purge accumulation with all water and non-fat compared to non- massaged. They further concluded that insufficient massaging time and physical disruption of massaged pre-blend meat, as a result of mincing through 1.4 mm plates may disrupt the established hydrophillic bonds developed during massaging, especially the weaker bonds between water and proteins. This can be improved by increasing the massaging time in hot boned meat with due care to avoid over massaging. Ockerman and Wu (1990) found that better emulsion type products can be produced by hot boning followed by tumbling for 12 hr. Such products have higher emulsifying capacity, WHC and higher percentage of free water (Ockerman, 1983 ; Ockerman *et al.*, 1990).

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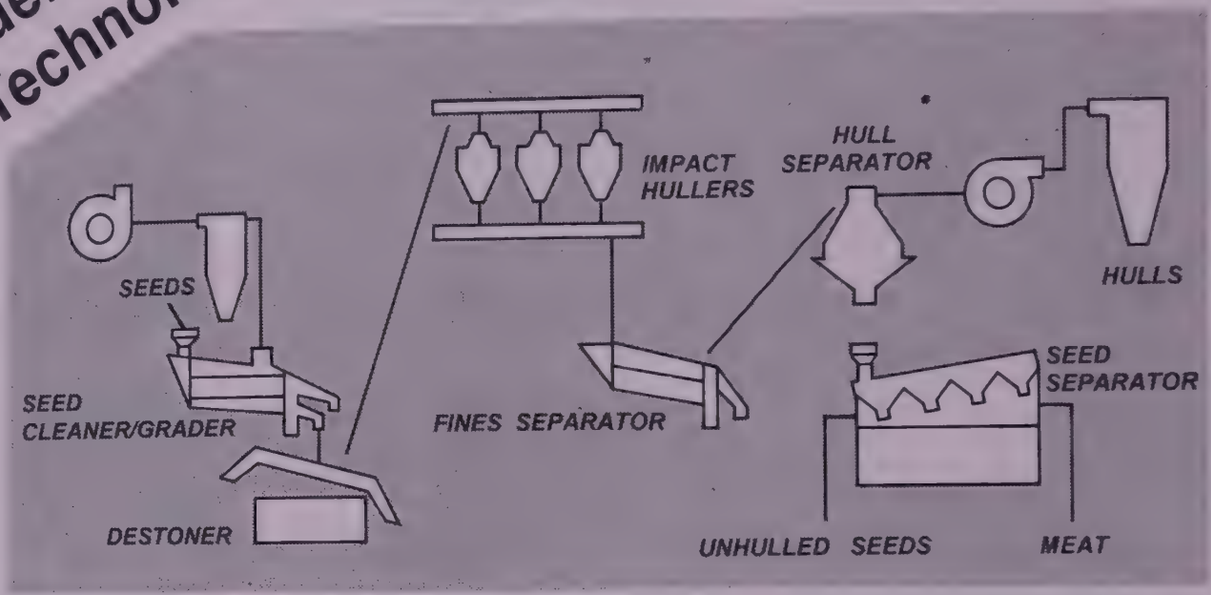

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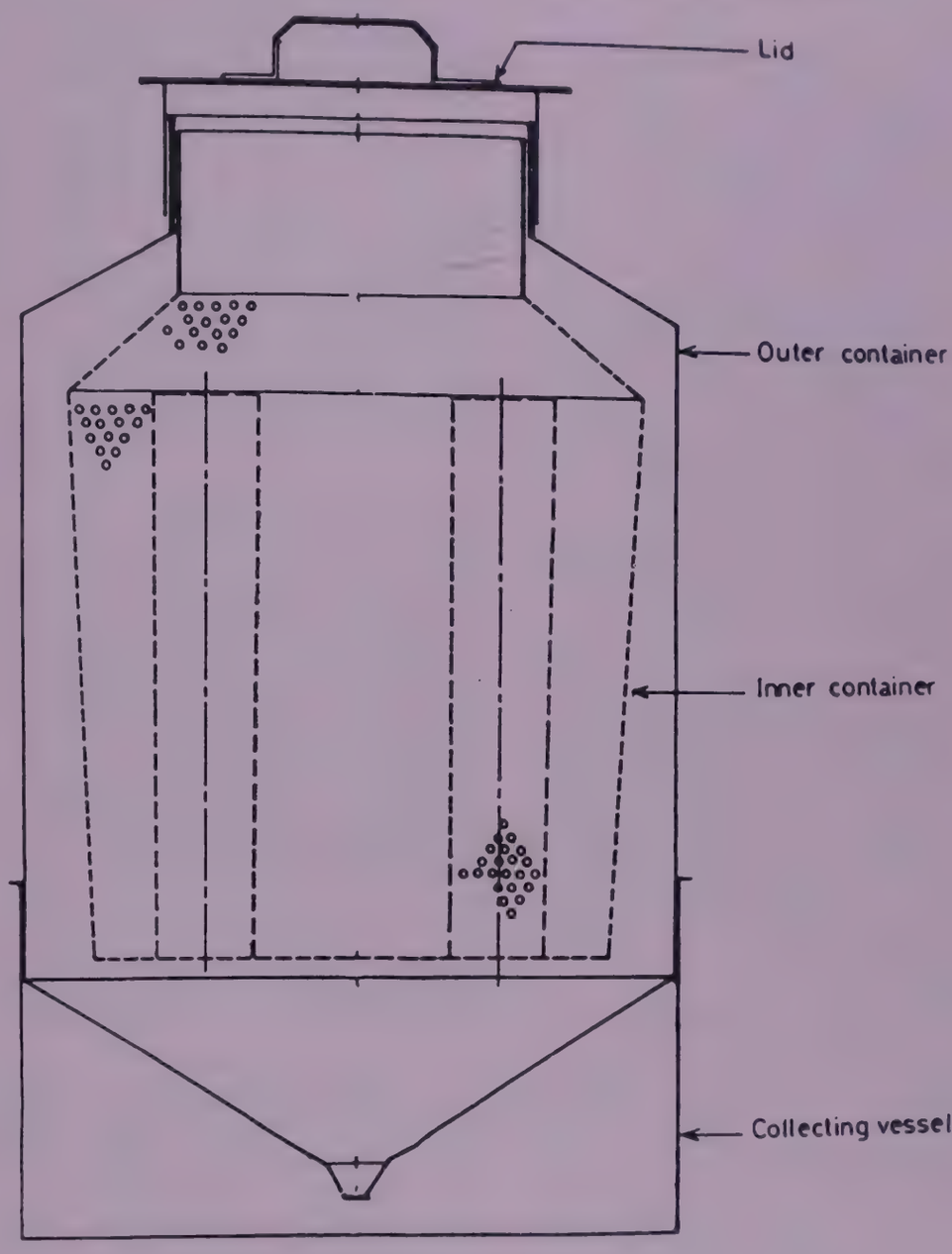
A Storage Container for Automatic Removal of Insects from Grains

Among various enemies of stored foodgrains, insects are the most important, posing a serious problem at homes, farms and warehouses. In most tropical countries, only one fifth of the harvest is stored in large warehouses in urban areas. The bulk is kept for subsistence and stored in farms and homes in different storage structures. As the use of pesticides poses serious health and pollution hazards and further handling of such pesticides at home and farm for grain is far from practice, development of scientific storage structures for storing grains will have a great impact in stored product insect protection.

New concept : Recently, a storage container model of 2 kilogram capacity, which can remove insect automatically was developed by Dr. S. Mohan, Asst. Professor in the Department of Agriculture TNAU, Coimbatore. The structure has 4 major parts namely, outer container, a 2 m.m inner perforated container, collection vessel and the lid (Figure) The model exploits the wandering behaviour of stored product insects as well as the movement of these insects towards well aerated regions. The grains are held in the specially designed inner perforated container. The space between inner and outer container provides good aeration for the insects.

Insects, while wandering enter the perforation to reach the aerated part and while doing so, get slipped off and fall into the collection vessel through a pit fall mechanism provided in the collection vessel. In order to quickly collect the insects, as and when they emerge from grains, three perforated (2mm) roads are fixed in the inner container.



The container will be useful for storing rice, wheat, grams, pulses, corriander etc. The insects such as rice weevil, lesser grain borer, red flour beetle, saw toothed beetle, which are commonly found attacking stored grains can be removed automatically by storing grains in this container. Within a very short period of 1-10 days, a majority of the insects (75-90 percent) can be removed. Scaling up of this model to different capacities namely, 25, 50, 100 and 500 kg and studying their effectiveness are being attended to at this institute.

For details contact
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Continued on page 47

RESEARCH ROUND-UP

CFTRI Set on New Frontiers of Research Activities

The Central Food Technological Research Institute (CFTRI), Mysore is gearing itself to go global through its hi-tech technology marketing in grain processing, fruits and vegetables, spices and marine products.

In this direction, this premier Institute is organising an all- India industry get-together in Mysore on October 20 and 21 1995.

The Institute has initiated industry-wise interaction in Bangalore, Bombay, Madras and Calcutta. Realising that the global competition demanded higher efficiency, product quality, superiority and presentation, such an interaction is needed, according to Dr. V. Prakash, Director, CFTRI.

Eight New Processes

Talking to presspersons that Dr. Prakash said the process of interaction which had made a beginning eight months ago had resulted in eight new processes in the market such as mushroom process and the most sought-after drip-loss processing in prawns. The Institute was focussing on the areas of pepper sterilization and certain instant food products, the objective being to ensure substantial cash flow from the entrepreneurs, who wished to adopt CFTRI technology for better marketing of the products.

Dr. Prakash pointed out that such an exercise would enable the Institute to become self-reliant financially. He said that in 1994-95, the cash flow from entrepreneurs amounted to Rs. 334 lakhs and for the current financial year, it was expected to cross Rs. 430 lakhs, apart from funds from the Council of Scientific and Industrial Research (CSIR). The extraneous cash flow accounted for nearly 28 per cent, which in the expectations of the CSIR was expected to cross 50 per cent.

Dr. Prakash said that the Institute had active collaboration with the Food Corporation of India (FCI). One of the projects undertaken for FCI was to educate farmers to store their produce in controlled conditions to have better quality products through the use of food protectants. However, he accepted this required large-scale planning for reducing wastage of grain arising from improper storage.

Dr. Prakash said as a result of interaction between the major funding agencies in the Union government, the CFTRI had established a food-engineering centre costing Rs. 4.90 crores. Similarly, he said that the National Facility for Food Safety operational here since April 1 was yet another major project under way at a cost of Rs. 2.09 crores. Also, technology mission on oilseeds and pulses with a sanctioned grant of Rs. 1.48 crores from the Union Ministries of Agriculture and Cooperation would result in an estimated saving of Rs. 1,200 crores, through avoiding import of edible oils to meet the shortfall in the country.

Package System

The CFTRI was also engaged in developing a packaging system using aluminum cans at an estimated cost of Rs. 97 lakhs funded by the Union Ministry of Food Processing Industries. Since the country accounted for 60 per cent of the world supply of aluminium, he said that it was proposed to use it for manufacturing containers for preserving processed foods replacing tin-based containers which had become expensive.

Dr. Prakash said the collaboration with international agencies such as the Indo-Swedish programme for Biotechnology-lactic acid costing Rs. 45 lakhs, the Indo-Australian programme for phosphine at Rs. 21 lakhs, the Indo-EEC mango product scheme at Rs. 33 lakhs and Indo-U.S. programme for seed proteins at Rs. 38 lakhs was under way. He added that the United Nations University Programme for Advanced Level Human Resource Development was being revived, and the Indo-U.K., programme in specialized areas of food science and technology had been initiated.

High Levels of Carcinogens in Indian Beer

An Indian study undertaken by the National Institute of Nutrition (NIN), Hyderabad, has shown an average of 3.6 parts per billion (ppb) of the carcinogen n-nitroso dimethyl amine (NDMA) in

more than 100 out of the 120 samples tested.

This is higher than the level in the West, NIN researchers, Mr. M. P. R. Prasad and Mr. K. Krishnaswamy report in the latest issue of the "Indian Journal of Medical Research".

Samples obtained from the Southern States showed higher levels of NDMA than those from the north.

The average NDMA level in India beers is 3.6 ppb, which is as high as some of the beers in Western countries, a decade ago. Currently, the average NDMA level is 0.14 ppb in Germany, 0.3 in Sweden, 1.6 in Japan, 1.2 in the Netherlands.

Over 100 brands of Indian beers contain a class of cancer-causing chemicals in amounts higher than those found in the West, according to medical researchers.

Similar contamination of Western beers with a group of carcinogens called n-nitrosoamine found in the eighties had led to changes in malting technologies to a third of what was found a decade ago.

The first comprehensive evaluation of the presence of volatile n-nitrosoamines (VNA) in beers came from Germany in 1980, which showed the beer consumption alone was responsible for 65 per cent of the daily intake of VNAs. In most Western countries, beer contributes 30-80 per cent of daily intake of VNA.

In India,the cancer registry data indicate a higher incidence of stomach cancer in Madras, compared to northern and western area registries. This may be due to the high levels NDMA in brands available in Tamil Nadu, Karnataka and Andhra Pradesh, the report says.

NEW MACHINERY ..... Continued from page 45

A New Aseptic Pack

Tropical Fruits International Ltd., (A Russian Joint Venture) is one of the largest bulk producers of fruit pulps for export. They have been dealing mainly in the bag-in-drum aseptic pack of 210 kg nett. Of late, there has been a demand for a smaller pack from small scale reconstituters and retailers, especially from Gulf countries. To meet this demand, they have introduced a 20 kg aseptic bag-in-box pack to cater to this market. According to them, this pack will be a replacement for the conventional pack of the metal cans with no tin or lead content in the product.

They have designed this pack as a horizontal pillow pack, which they claim, the stackability is excellent and thereby cold storing, if necessary, will be easy.

They expect a very large demand for this pack during the next fruit season.

For details contact :
General Manager(Works)
Tropical Fruits International Limited
Post Box No. 8616
Opp. Harekrishna Hills,
Mahalakshmipuram Layout
Bangalore - 560 086

CFTRI HIGHLIGHTS

CFTRI Develops Process for Quick Cooking Rice

The Central Food Technological Research Institute has developed a process for the preparation of quick cooking rice. The dehydrated cooked rice can be rehydrated, when required by adding a measured quality of boiling water. For one volume of quick cooking rice, take two volumes of water. Boil water, add rice and continue to boil for 6-7 minutes. The rice is ready for serving. The product has a shelf life of 6 months.

Today, with the vast array of new and developing food technologies spurred by the ever increasing demand for quality, convenient rice products is preferred as a base. Its versatility of fitting into every cuisine is substantiated by the fact that varied ethenic groups use rice as their base food ingredient. However, regular rice has always been limited as an ingredient in the application for convenient food products because of its relatively long cooking time.

Rice is generally consumed only after it is totally cooked. Ordinary milled rice requires 20-25 minutes to cook in water to a satisfactory culinary acceptability. Various rice varieties yield cooked rice of different textural characteristics. Variations in recipes also have significant effect on the texture, flavour and acceptability of the cooked rice.

The process for the preparation of quick cooking rice consists of grading and cleaning of milled rice, soaking, cooking, drying and packing into unit packs.

The equipment required are available indigenously. The design drawing can be supplied by CFTRI.

The following are the special features of the process.

1. The process does not require any pre-treatment step, like roasting, fissuring etc.

2. The process does not use any chemicals or additives.

3. The cooked rice prepared by the process compares well with the standard market product available abroad.

4. The process involves simple steps like soaking in water, steaming and drying.

5. Varietal variations of rice do not much impair the characteristics of the cooked rice prepared according to the process of the invention except for aging of rice.

6. The product developed by the above process suits the traditional Indian rice cooked conventionally.

7. The product can be readily incorporated in any of the standard Indian recipes for production of ready-to-eat foods.

The quick cooking rice has good potential both in domestic market as a base material for instant foods and also for export market. India currently exports more than 4 lakh tonnes of *basmathi* rice worth more than Rs. 1000 crores.

The product can be packed in 250 gauge HDPE or in metallized polyster with printed carton as outside cover.

For further details, contact
The Director,
CFTRI,
Mysore - 570 013.

Different Selected Chillie Varieties of India

Chilli - A Fascinating Spice

Chilli is the universal spice of India. It is cultivated in all the States and Union Territories of the country. The important States growing chilli are Andhra Pradesh, Orissa, Maharashtra, West Bengal, Karnataka, Rajasthan and Tamil Nadu. Andhra Pradesh alone commands 46 per cent of the chilli production in India. As per the latest statistics, India produced 7,79,000 tonnes of dry chilli from an area of 9,17,600 ha. No country in the world has so much area and production of chilli as in India.

Chilli is nature's wonder. Its fruit appears in different sizes, shapes and colour. The fruit size of some varieties is more than hundred times that of others. The shape may be elongated or round, and distal end pointed, blunt or sucked in. Corrugated, leathery or smooth may be the touch on outer skin. It may look like a bird's eye or a small orange fruit. Colour varies from blue, green, orange, red, yellow, violet, cream white to near black.

Chilli has two important commercial qualities. If some varieties are famous for red colour because of the pigment capsanthin, others are known for biting pungency attributed by capsaicin. India is the only country rich in many varieties with different quality factors.

Chilli is an essential ingredient of Indian curry. Curry is characterized by tempting colour and titilating pungency. Both are contributed by chilli. In curry, chilli is used as a paste, powder, broken split or while form. There are Indian pickles, especially with tender mango in which chilli powder is added lavishly to form a thick paste with biting sensation at the end of curing. In all Indian homes, chilli is used by the poor and the rich alike.

While consumption of chilli is the highest in India, maximum export is also from this country. India made the record export of 33,450 tonnes of dry chilli in 1993-94. Oleoresin of chilli with low, medium or high pungency is also exported in large quantities. Chilli powder is another important item of export. Indian chilli and its products are bought by a number of countries. Important among them are Sri. Lanka, Bangla Desh, South Korea and USA for dry chilli and USA, Germany, Japan, U.K and France for oleoresin. India can supply chilli as whole, powder or oleoresin in consistent colour and required pungency.

Guntur Sannam - S4 Type

This is grown in Guntur, Warangal, Khammam District of Andhra Pradesh. Skin is thick, hot and red. Harvesting season is December to May. Annual production is 2,80,000 tonnes. It is available in Guntur market ASTA Colour Value - 32.11, Capsaicin - 0.226%

Jwala

It is grown in Kheda, Mehsana and in South Gujarath. It is highly pungent, light red in colour, short and the seeds are compact. Harvesting season is September to December. It is available in Unjha market. Capsaicin 0.4%.

Nalchetti

This variety is grown in Nagpur District of Maharashtra. It is red in colour and extremely pungent. Harvesting season is January to March. Annual production is 2500 tonnes. It is available in Nagpur market ASTA. Colour Value - 77.03, Capsaicin - 0.12%.

Sangli Sannam - S4 Type

This is grown in Kolhapur District of Maharashtra. It is light red on colour and hot. Harvesting season is September to November. Its annual production is 3000 tonnes. It is available in Bombay and Kolhapur. Its ASTA Colour Value - 73.55, Capsaicin - 0.215%.

Scotch Bonnet

This variety was introduced from Jamaica. Cultivation in India is on the initial stage. Studies show that it comes up well in the hilly regions of Kerala and Karnataka. It may be possible to grow in other parts of India as well. Chilli is short round and yellowish in colour with the terminal end sucked inside. ASTA Colour Value - 38.25, Capsaicin - 0.878%.

Kashmir Chilli

This is grown in temperate regions such as Himachal Pradesh, Jammu and Kashmir and also in sub-tropical regions of North India during winter

season. It is long, fleshy, deep red in colour.

Harvesting season is November to February. It is available in major markets of North India, ASTA Colour Value - 54.10, Capsaicin - 0.325%.

Tomato Chilli (Warangal Chappatta)

This is grown in Warangal, Khammam, East and West Godavari Districts of Andhra Pradesh. Its colour is deep red and it is less pungent. Harvesting season is December to March. ASTA Colour Value -124.26 Capsaicin - 0.17%.

Bydagai (Kaddi)

It is grown in Hubli-Dharwar District of Karnataka. It is red in colour with less pungency or without pungency. Harvesting season is January to May. Annual production is 21,000 tonnes. It is available in Hubli- Dharwar market. ASTA Colour Value - 156.9, Capsaicin- Negligible.

Ramnad Mundu

This variety is grown in Ramnad District of Tamil Nadu and it is yellowish red and hot. The harvesting season is March to May. Its annual production is 12,000 tonnes. It is available in Virudunagar and Ramnad District of Tamil Nadu. ASTA Colour Value - 32.95, Capsaicin - 0.166%.

Ber Variety - S9 Mundu

This variety is grown in Anantpur District of Andhra Pradesh. Its colour is Tomato red with fairly good pungency.

Harvesting season is February to April. Annual production is 700 tonnes. It is available in Anantapur District of Andhra Pradesh.

Nagpur Mundu

This variety is grown in Nagpur District of Maharashtra. It is red in colour and pungent. Harvesting season is January to March. Annual production is 5000 tonnes.

It is available in Bhimapur market of Maharashtra.

Madhya Pradesh G.T. Sannam

This variety is grown in Indore, Malkapur Chikli and Elachpur areas of Madhya Pradesh. It is red in colour and pungent. Harvesting season is January to March. Annual production is 7500 tonnes. It is available in major markets of Madhya Pradesh.

Madras Pari

It is grown in Nellore District of Andhra Pradesh. It is pure red in colour and hot. Harvesting season is March to May. Annual production is 2000 tonnes. It is available in Madras. ASTA Colour Value - 73.82, Capsaicin - 0.206%.

Kanthari White

This is grown in Kerala and some parts of Tamil Nadu. It is short and ivory white in colour with high pungency. It is mainly grown as a homestead crop . It is available in markets throughout the year. ASTA Colour Value - 2.96, Capsaicin - 0.504%.

Bird Eye Chillie (Dhani)

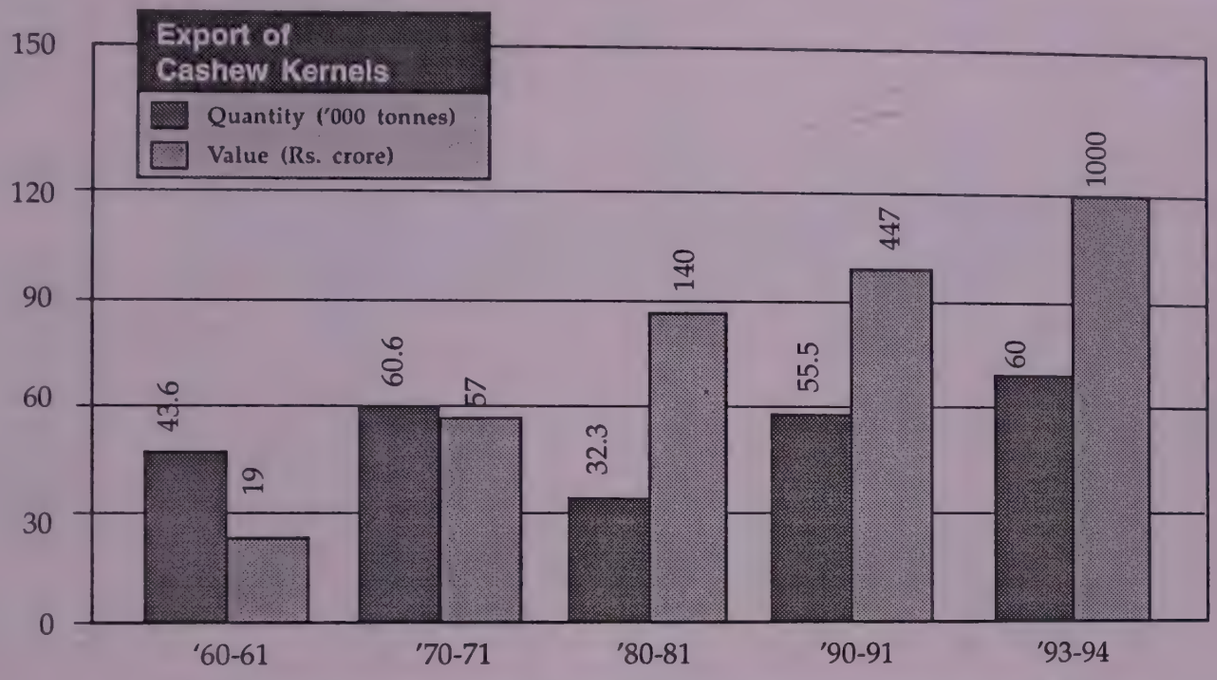
This variety is grown in Mizoram and some areas of Manipur. Its colour is blood red and is highly pungent. Harvesting season is October to December. It is available in Calcutta Market ASTA Colour Value - 41.7, Capsaicin - 0.589%.

Ellachipur Sannam - S4 Type

This variety is grown in Amaravathi District of Maharashtra. It is reddish in colour and very hot. Annual production is 1800 tonnes. Harvesting season is September to December. It is available in Bombay, Delhi, Ahmedabad and Nagpur. ASTA Colour Value - 70.40, Capsaicin - 0.2%.

DATA BANK

Export of Cashew Kernels



Country-wise production of raw cashewnuts - 1991

(in Tonnes)

India	:	300,00
Brazil	:	184,000
Indonesia	:	40,000
Vietnam	:	35,000
Nigeria	:	35,000
Mozambique	:	20,000
Tanzania	:	20,000
Costa Rica, Honduras, Venezuela, Guatemala & Panama	:	20,000
Guinea Bissau	:	15,000
Malaysia	:	15,000
Sri Lanka	:	10,000
Kenya	:	9,000
Ivory Coast	:	6,000
Philippines	:	5,000
Madagascar	:	4,500
Togoland	:	2,500
Benin	:	2,000
Australia	:	1,200
Total		**734,000**

Import of Raw Cashewnuts to India

Countries	Value in Rs. Lakhs		Quantity in MT	
	Apr. '92-Mar. '93		Apr.'93-Mar.'94	
	Q	V	Q	V
Benin	3581	992.59	8386	1665.49
Brazil	3895	998.26	-	-
Equitl. Guinea	-	-	5633	1547.80
Ghana	-	-	25	5.72
Guatemala	251	64.41	-	-
Guinea	3733	1381.37	3542	1113.08
Guinea Bissau	5500	1998.33	6929	1828.73
Honduras	290	82.02	-	-
Indonesia	11540	3122.43	19196	5113.86
Ivory Coast	8791	2423.37	16710	4748.60
Kenya	-	-	1046	262.49
Malagasy Rep	266	68.01	348	66.66
Mozambique	13973	3435.62	17772	4498.3
Netherlands	-	-	100	26.70
Nigeria	12509	3109.98	10607	2356.13
Philippines	286	80.42	1148	289.18
Portugal	238	65.91	-	-
Senegal	1132	291.27	1222	297.43
Singapore	255	61.27	6267	1636.71
Spain	-	-	146	40.43
Tanzania Rep	27728	7974.23	60538	14465.87
Thailand	195	52.20	400	108.18
Togo	942	257.23	228	41.79
USA	-	-	521	155.85
Vietnam Soc Rep	39880	11174.19	31393	8000.82
Total	**134985**	**37633.12**	**190151**	**48270.17**
Unit Value Rs/MT		27879		25384

Share of Munch

Shares of the 3,000 tonnes potato chips market (1993-94)

Uncle Chipps %	65
Hostess Ruffles %	20
Binnies %	10
Others	5

DATA BANK

Export of Sesame Seed from India

Year	Export of Sesame seed (Tonnes)	Value (Rs. crores)
1988-89	18,885	19.90
1989-90	1,38,530	178.10
1990-91	47,187	72.10
1991-92	33,533	61.50
1992-93	48,497	82.60
1993-94	22,000	41.30

Milk Production in Different States of India in '000 tonnes

State	1992-93	1993-94
Andhra Pradesh	3103	3950
Bihar	3360	3450
Gujarat	3546	3795
Haryana	3715	3740
Karnataka	2590	2662
Kerala	1889	2000
Madhya Pradesh	4879	5012
Maharashtra	4102	4250
Punjab	5583	6045
Tamil Nadu	3468	3775
Uttar Pradesh	10649	11000
West Bengal	3023	3400

ADVERTISERS' INDEX

TRADE FAIRS & GET-TOGETHERS

Mark Your Calendar for ANUGA '95

ANUGA is the largest food and beverage show in the world, scheduled for September 30-October 5, 1995, in Cologne, Germany. Last time, ANUGA was held in 1993, and 190,822 visitors from 132 countries were there. Eight percent of the U.S. exhibitors at that show said they would participate again.

Seventy percent of exhibitors in the USA Hall at ANUGA '93 satisfied their sale objectives - contacts made at the show facilitated an average of more than $350,000 in new sales per company. In addition, 96 companies successfully test marketed more than 500 products during the show.

Exhibiting at ANUGA offers many advantages for small and medium- sized firms. Most visitors are senior marketing or sales managers, who have the power and authority to make purchases, while one- third of the show's visitors come from outside Germany, guaranteeing a world-wide audience for U.S. products.

At ANUGA '95, FAS will sponsor 90 booths for a fee that includes advance publicity, product shipment and assistance with customs clearance. For more information about ANUGA, contact Sarah Hanson, USDA trade show coordinator, at (202) 720-9423.

General information about the show can be obtained from the U.S. representatives of ANUGA - Cologne International Trade Fairs, Inc. Call Hans J. Teetz or Marlies M. Osmers in New York.

Tel (212) 974-8837, Fax (212) 974-8838, or Angelika Berger in Los Angeles, Tel 310-297-7877/78 Fax (310) 297-7966.

FOOD PRO '95

Confederation of Indian Industry (Southern Region) announces a major exposition on the Food Processing Industry - FOOD PRO '95, which will combine an International Exhibition with Conference on the Food Processing Industry, to be held in Madras from 11-14th October 1995. The FOOD PRO '95 conference would provide the interactive forum for dialogue and debate on the entire gamut of issues related to the Food Processing Industry. The FOOD PRO '95 exhibition would be a show case for the latest international advancements in the Food Processing Industry. It will be a meeting point for lead players in the Food Processing Industry to market their product range.

For more details, write to :
K. Harish,
Executive Officer,
Confederation of Indian Industry,
Southern Region Headquarters,
13, Harrington Road,
Chetput,
Madras - 600 031

National Symposium on "Frontiers in Applied Environmental Microbiology" during December 11-13, 1995

School of Environmental Studies, Cochin University of Science and Technology, Cochin is organizing a National Seminar on "Frontiers in Applied Environmental Microbiology" during December 11-13, 1995 at Cochin. The thrust areas to be covered are : Microbial management of solid and liquid state; Microbial quality and quality control of potable and recreational waters ; Microbial control of insect pests ; Biofertilizers ; Microbial leaching and biomining ; Microbial fouling and corrosion ; Pesticide microbiology ; Petroleum microbiology ; Microbial productivity and diversity in nature ; and Microbial technology for controlled aquaculture environments.

For further details, contact :
Dr I. S. Bright Singh,
Convenor,
National Symposium,
School of Environmental Studies,
Cochin University of Science and Technology,
Fine Arts Avenue,
Cochin - 682 016, Kerala

National Seminar on Post-harvest Technology of Fruits "Phal Samskarana - 95"

The University of Agricultural Sciences, Bangalore is organizing a National Seminar on Post-harvest Technology of Fruits - 'Phal Samskarana-95" during August 7-9, 1995. The Seminar is being sponsored by McGill University-CIDA-ICDS, BAMPHE Project Canada, Central Institute of Post-harvest Engineering and Technology, ICAR, Ludhiana, National Horticultural Board, Government of India, New Delhi, Department of Horticulture, Government of Karnataka and Horticulture Produce Co-operative Marketing Society, Bangalore. The venue of the seminar is University of Agricultural Sciences, Bangalore, Hebbal Complex, Bangalore. An exhibition is also arranged to demonstrate Fruits / Fruit Products / Technologies / Processing Machinery, R&D establishments, Government and Non-government organisations. Interested exhibitors are requested to contact Dr. Javare Gowda, Prof. and Head, Dept. of Agri, Eng. UAS, Bangalore - 560 024, who is the organizing Secretary for more details before June 30, 1995.

The Quang Trung International Trade Fair '95, Ho Chi Minh City (Vietnam) November - 7-11, 1995.

The India Trade Promotion Organisation (ITPO) is organising India's participation in the above mentioned fair. This is one of the significant International Trade Fairs in Vietnam, where Indian companies can generate business by displaying their exhibits.

Besides demand for other products in Vietnam, there is a considerable scope for export to Vietnam of Indian Agricultural Machinery and Equipment, Industrial Machinery and Equipment & Plant and Machinery for Agro Processing Industries.

The participation fee for this fair that been highly subsidised and is being fixed in the vicinity of Rs. 6000/- per sq. mtr. Minimum bookable space is 9 sq. mtrs. or in multiples thereof. Against the participation fee, ITPO offers a comprehensive package of services, which includes built-up stand, floor covering, lighting, furniture, normal display aids, to & fro shipment exhibits, insurance and handling/clearing of exhibits in India and abroad, general publicity support etc. Please contact, India Trade Promotion Organisation, Pragati Maidan, New Delhi - 110 001 Tel : 3318143 Fax : 91-11-331-8142, 91-11-332-0855, 91-11-331-7896 Telex : 031-61022, 031-61311 COMEXH IN, 031-65155 ADEP IN Cable : COMEXH

Spices Board to Participate in Six Overseas Food Fairs

Spices Board has finalised six international food fairs for its participation during the financial year 1995-96. The fairs were selected based on importance from point of view of trade.

The fairs are :

Fine Food Sydney, Australia from 3rd to 6th September 95

Anuga World Food Market, Cologne, Germany from 30th September to 5th October 95

Food Ingredients European, Frankfurt, Germany from 7th to 9th November 1995

International Autumn Trade Fair, Dubai, from 7th to 11th November 95.

Course on Fumigation, Pest Control and Prophylactic Treatment

This has been scheduled from 5th June to 16th June '95 at the Central Food Technological Research Institute at Mysore.

The course content, desirable qualification and training charges of the course of the said course is a follows :

Course Content

The Training includes the following topics, both Theory and Practicals on

- Insect pest of stored grains.

-Effects of pest on grains and their detection.

- Economic importance of insect pests in non-food materials.

- Detection of infestation.

- Household insect/pest problems in hospitals, theatres, food mills & food processing units, tobaccos etc.

- Rodent pests of economic importance and their control.

- Fumigants and their properties, detection and monitoring and analysis.

- Fumigation equipment.

- Carbon dioxide fumigation.

- Aeration and prophylactic treatments.

- Pesticide use as protectants.

- Fromulation of spray equipments.

- Occupational and their control in stored products.

- ISI/PFA Specifications and registration protocols.

- Integrated pest managment.

Desirable Qualification

The minimum qualification prescribed is a degree in science/agriculture/technology/engineering. This is relaxed in case of Trainees who have studied at least Physics, Chemistry and Mathematics at the Pre-university or 12th Standard and have adequate practical/working knowledge. The medium of instruction is English.

Training Charges :

a. Training Fee	Rs 3200/-
b. Boarding Charge	Rs 1055/-
c. Lodging Charged on Institute campus	Rs 325/-
Total	Rs 4580/-

The training charges, can be sent through crossed draft in favour of Director, CFTRI, Mysore.

For further details, contact
Director
CFTRI, Mysore - 570 013.

International Seminar on "Challenges facing fats, oleochemicals and surfactants in the 21st Century" and Expo

The Oil Technologists' Association of India (OTAI), Western Zone is organizing an International Seminar on "Challenges facing fats, oleochemicals and surfactants in the 21st Century" and Expo at the Nehru Centre, Worli, Bombay - 400 018, India during 19-22, December 1995 followed by an exposition from 20 to 22 December 1995. The major objectives of the seminar are (i) to highlight the achievements of the Indian Industry and to explore the scope for further improvements in the present day context (ii) to promote interaction of national and international experts, specialists and leaders of industry and identify business opportunities and necessary developmental activities. The seminar is being organized with the co-operation of many national and international scientific bodies.

For more details contact :
Dr. D. N. Bhowmick,
Organising Secretary,
Division of Oils, Fats and Waxes,
Department of Chemical Technology,
University of Bombay,
Matunga, Bombay - 400 019 India
Tel : (91-22) 4146526
Fax : (91-22) 4145614

AWARDS

Twentieth Century Achievement Award

Dr. S. Ranganna, Retired Head, International Food Technology Training Centre, CFTRI, has been conferred the "Twentieth Century Achievement Award" by the Board of Directors of the American Biographical Institute of the United States of America.

An eminent fruit and vegetable technologist and educationist, his work on canning of drinking water, thermal process for canned fruits and vegetables, development of strained baby foods from fruits and vegetables, low-methoxyl pectin and on discolouration in canned and dried fruits and vegetables are well known, and his sterling contribution has been in the field of human resource development, having been at the helm of training activity for nearly four decades in the internationally recognized Institute, CFTRI.

Author of several research papers published in national and international journals, Dr. Ranganna's Magnum opus "Handbook of analysis and quality control in fruit and vegetable products" published by M/s Tata - McGraw Hill is like the 'AOAC' for the workers in the field for the developing countries, besides India.

The career achievements and social contributions of Dr. Ranganna have been selected for permanent documentation in "Five hundred leaders of influence" designed for biographical reference and inspiration for present day citizens of the Twentieth Century as well as future generations.

The volume is stated for release during early 1996.

Announcement

ICFoST

Annual Convention

On

Food Process Engineering - Recent Trends and Developments

September 7-9, 1995, Mysore, India

Jointly organised by

Association of Food Scientists & Technologists (India), Mysore

and

Central Food Technological Research Institute, Mysore

Along with a number of Co-sponsors

Technical Programme : Lead Papers and Keynote Presentations on

Cryogenic engineering in food processing, Supercritical fluid extraction technology, High pressure technology, Heat and cooling processes, Process design and evaluation, Extrusion cooking, Bio-engineering, Food machinery development, Packaging, storage & distribution engineering and Membrane processing.

Poster Session on : Food Science and Technology, Last date for receipt of Abstracts for Poster Session in the prescribed format is July 15, 1995.

Registration Fees :

	AFST (I) Member	Non-Member	Non-Indian
Upto 30-6-95	Rs. 300/-	Rs. 550/-	US $ 250/-
1-7-95 to 31-8-95	Rs. 400/-	Rs. 650/-	US $ 350/-

Advertisement tariff in Souvenir :

Back cover (Colour)	10,000/-	Inside cover (Colour)	8,000/-
Special insertion	4,000/-	Delux insertion (Tricolour)	5,000/-
Full page (colour paper)	6,000/-	Full page (Ordinary)	3,000/-
Half page	2,000/-		

Exhibition : Cyma system stalls (10' x 8') - complete with 2 electrical points, 1 table and 2 chairs. Rs. 5,000/- (Food Processing Equipments, Machinery, Books, Journals, Chemicals, Scientific Equipments, etc.,)

Accommodation : Request may be sent to the undersigned on or before 31st July 1995. The Hotel tariffs are in the range of Rs. 150 to 2000 per day. Accommodation can be booked in advance by a deposit of one day tariff.
Please send your payments by Demand Draft drawn in favour of ICFoST-95.

For further details contact :

Dr. K. Udaya Sankar

Hon. Exec. Secretary, AFST(I), CFTRI Campus, Mysore - 570 013

Telefax : 91-821-521747 and E-mail : afst @ nicfos.ernet.in

AFST(I) NEWS

AFST(I) Calcutta Chapter

Association of Food Scientists and Technologists (India) Calcutta Chapter in collaboration with the Department of Food Technology and Biochemical Engineering, Jadavpur University organized a National Seminar on "Total Quality Management in Food, Fermentation and Allied Industries" during 20-21, January 1995 at Calcutta. The seminar was sponsored by the Ministry of Food Processing Industries, New Delhi. Shri Tarun Gogoi, Minister of State for Food Processing Industries, Government of India, New Delhi inaugurated the seminar. Prof. S. C. Som, Vice-chancellor, Javadpur University, Prof. A. N. Bose, Chairman, Organizing Committee, Prof. T. K. Ghosh and Shri A. R. Molla, Minister-in-charge, Department of Food Processing Industries, Government of West Bengal addressed the inaugural session.

The seminar was spread over 6 technical sessions (i) Core concept of total quality management ; (ii) Consumer focus and total customer satisfaction ; (iii) Human resources development and management (iv) ISO 9000 (IS 14000) ; (v) Statistical quality control and HACCP and (vi) Quality management with special reference to food and fermentation industries. Many distinguished experts presented their papers at the respective technical sessions. Over 200 delegates attended the seminar held for those two days.

The following recommendations were formulated at the concluding session, presided over by Prof. T. K. Ghosh

(i) Since total quality management has been developed and standardized over a period of time, it should be adopted in food, fermentation and allied industries

(ii) In process quality control, involving statistical quality control and hazard analysis in critical control points should be practised

(iii) Help from good quality laboratories should be ensured

(iv) Food at consumer level from food and fermentation industries should ensure safety from toxic chemicals, particularly pesticides and microbes

(v) Total quality management in food handling establishments should care for total hygiene of the manufacturing environment including personal hygiene of the handlers

(vi) The materials and practices of total quality management should be eco-friendly by all means

(vii) The above mentioned considerations should equally apply to small and cottage scale industries of food and fermentation

(vii) AFST (I) may conduct a training programme as continuing Education Programme on quality of food and quality management in food, fermentation and allied industries and

(ix) Total quality management systems should be so formulated that there is no reasonable occupational risk to the concerned workers.

JFST CONTENTS

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